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SUMMARY OF CONTENTS.

(*For Details, see over.*)

PAGE

Fifty Years of Nile Exploration, and Some of its Results. By Sir WILLIAM GARSTIN, G.C.M.G. (*Plate and Maps*) . . . 117

The Panama Canal in 1908. By VAUGHAN CORNISH, D.Sc., F.R.G.S., F.G.S., F.C.S., M.J.S. (*Illustrations and Map*) . . 153

Survey Work on the Frontier between Bolivia and Brazil. By Major P. H. FAWCETT, R.A., Chief Bolivian Commissioner . 181

The Italian Earthquake of December 28, 1908. By R. D. OLDHAM (*Sketch-map*) 185

The Meteorology of the "Discovery." By H. R. M. . . . 188

Lake Kioga (Ibrahim) Exploratory Survey, 1907-1908. By Lieut. C. E. FISHBOURNE, R.E. (*Map*) 192

Swallow-holes in Chalk. By Colonel W. PITT, (late) R.E. (*Sketch-map and Sections*) 196

Reviews 199

The Monthly Record. Obituary. Meetings of the Society. Literature and Maps of the Month.

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The Geographical Journal.

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CONTENTS—FEBRUARY.

	PAGE
Fifty Years of Nile Exploration, and Some of its Results. By Sir William Garstin, G.C.M.G. (with Plate, Sketch-map, and Map)	117
The Panama Canal in 1908. By Vaughan Cornish, D.Sc., F.R.G.S., F.G.S., F.C.S., M.J.S. (with 4 Illustrations and Map)	153
Survey Work on the Frontier between Bolivia and Brazil. By Major P. H. Fawcett, R.A., Chief Bolivian Commissioner	181
The Italian Earthquake of December 28, 1908. By R. D. Oldham (with Sketch-map)	185
The Meteorology of the "Discovery." By H. R. M.	188
Lake Kioga (Ibrahim) Exploratory Survey, 1907-1908. By Lieut. C. E. Fishbourne, R.E. (with Map)	192
Swallow-holes in Chalk. By Colonel W. Pitt, (late) R.E. (with Sketch-map and Sections)	196
Reviews:— EUROPE—Mountains of Northern Spain. Landslips in Italy. ASIA—China. AMERICA—Resources of Northern Canada. British Columbia. Mexico. Central America and Peru. AUSTRALASIA AND PACIFIC ISLANDS.—Dutch New Guinea. Old and New in Fiji. POLAR REGIONS.—The Greenland Eskimo. GENERAL—Francis Galton's 'Memories.' Text-Books. SHORT NOTICES	199
The Monthly Record	210

EUROPE
- Lapp Migrations between Sweden and Norway
- Projects of Canalization in the Regions of the Moselle, Sarre, and Chiers
- Historical Cartography of North-Western Europe

ASIA
- Cotton Culture in Asia Minor
- Indian Geodetic Operations
- Botanical Explorations in Fokien

AFRICA
- The Circumnavigation Scarabs
- Mr. Gardiner's Further Explorations in the Seychelles
- Forest Administration in Southern Nigeria

AMERICA
- Mr. Leffingwell's Explorations in North-West America
- Sir Francis Drake on the Coast of California

AUSTRALASIA AND PACIFIC ISLANDS
- Research in the Caroline Islands

POLAR REGIONS
- The French Antarctic Expedition

MATHEMATICAL AND PHYSICAL GEOGRAPHY
- Maps for Aëronauts
- The Freezing of Lakes
- The Weather and Anti-Cyclones in Europe and America

GENERAL
- The Practical Uses of Ski
- The Geographical Lectureship at Glasgow University
- Mr. Chisholm on the Definition of Geography: A Correction
- Association of American Geographers

Obituary—Prof. H. G. Seeley, F.R.S. By J. S. F. Robert Codrington. J. W. Brooke.	221
Meetings of the Royal Geographical Society, Session 1908-1909	224
Geographical Literature of the Month	224
New Maps	235

MAPS.

Maps of the Nile Region	121, 240
Map of Parts of Sicily and Italy to illustrate Mr. R. D. Oldham's paper on the Recent Earthquake	187
Sketch-map of North-East Hampshire near Alton	197
Map of the Panama Canal	240
Map of Victoria Nyanza to Lake Kioga (Ibrahim)	240

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CAPTAIN JOHN HANNING SPEKE, IN 1862.

The
Geographical Journal.

No. 2. FEBRUARY, 1909. Vol. XXXIII.

FIFTY YEARS OF NILE EXPLORATION, AND SOME OF ITS RESULTS.*

By Sir WILLIAM GARSTIN, G.C.M.G.

Fifty years ago the source of the White Nile was discovered by Captain Speke. The Jubilee of an event which has produced such far-reaching effect—politically as well as geographically—merits, I think, some recognition from all Englishmen, more especially from the members of this Society, to whose representatives—at the time of Burton's projected journey—it was mainly due that his expedition was rendered possible.

The present paper is, then, intended to recall to mind Speke's memorable exploit, and to indicate some of the results produced by it. I am well aware that I have nothing new to relate, and nothing, probably, that is not already well known to everybody. The literature of the Nile and its basin is so extensive, that but few facts now remain unchronicled—regarding either the physiography of the river, or the history of the countries that it traverses. All, consequently, that is left for me to do is to give a brief account of the principal events that have occurred—during the last fifty years—in connection with Nile exploration.

Under such conditions, my narrative can be little but a historical record, borrowed largely from the works of well-known writers.† I will endeavour to present it in an intelligible shape, and yet not exceed the limits of the time allotted to me. I shall divide the story into two periods. The first commences with the despatch of Burton and

* Read at the Royal Geographical Society, December 14, 1908. Map. p. 240.

† The works of which I have chiefly made use are, 'The Nile Quest,' by Sir Harry Johnston, G.C.M.G., K.C.B.; 'The Partition of Africa,' by Dr. Scott Keltie; 'The Foundation of British East Africa,' by Prof. Gregory.

Speke's expedition in 1856, and ends with the reconquest of the Sudan, by Lord Kitchener, in 1898. Within this space of time, the Nile sources were discovered, the basin of the river was explored, and the partition of Africa between the European Powers took place. The second period covers but ten years—from 1898 to the present day. In it, no startling geographical discoveries have been made, but much useful work has been accomplished, in mapping the Nile, and instituting scientific observations of its course and flow. Moreover, within this period, the Sudan has made steady progress towards prosperity, and Egypt has continued to profit largely by an effective distribution of the Nile waters.

Before, however, I touch upon the work of the last half-century, it is indispensable to my subject that I should make some reference to the state of knowledge existing, prior to Burton and Speke's expedition. My remarks will be brief.

From the very dawn of history, the secret of the Nile sources attracted the attention of the dwellers in its valley. Every conquering race in succession fell under the spell of this mystery and sought to solve it. This is not surprising. They saw a great river, rising they knew not where, and traversing many hundreds of miles of desert unassisted by a single tributary. They saw that it delivered an unfailing supply throughout the entire year, and—greatest marvel of all—they saw that, at the time when the sun's rays were most powerful, and the intense heat scorched and shrivelled up every green thing, its waters rose, overflowing their channel, saturating the adjacent lands, and converting tracts that would otherwise have been arid wastes into the most productive agricultural areas in the world.

I repeat, then, that it is small wonder if they sought to explain the origin of this marvellous stream, and the causes that led to the yearly inundation. Their simple minds instinctively turned to supernatural agency, and they were satisfied to account for these miracles, by ascribing them to a Deity whose special mission it was to control the Nile. As civilization and powers of thought increased, such explanations failed to satisfy men's minds. The legends were gradually discarded, and the geographers of the period began to attribute the origin of the Nile to natural causes. Many of the early writers discussed the subject at length. Among these, Herodotus was perhaps the most notable. The first rumour of the river sources being situated in a lake, would seem to have reached the outer world through the medium of traders to the eastern coast, and not by the course of the Nile itself. The physical difficulties of the Upper Nile valley must have proved potent factors in baffling all attempt at inquiry in that direction.

On the East Coast it was different. The Phœnicians and, later, the Greeks, in their constant voyages, touched at different ports, and entered into trade-relations with the inhabitants. These last brought

down ivory, precious metals, and slaves, for barter, from the interior to the coast. From these people the traders heard tales of great lakes, of large rivers, and of high, snow-clad mountains. These tales grew and multiplied, and from them was derived the information which eventually resulted in the map of Claudius Ptolemæus, produced in the second century of the Christian era.

Ptolemy's map, although containing many errors, is the first record of the Nile and its sources, possessing pretensions to even moderate accuracy. It has given rise to much discussion, and Ptolemy's statements have been much contested. Nevertheless, his chart marks a great step in the records of Nile geography. In it, he gives a fair general idea of the course of the river and of the junction of the Blue and White Niles. He shows the former as rising in a lake to the east, and the latter in two other lakes, lying far to the south. He also indicates the existence of snow-capped mountain ranges. This map, for many centuries, was the accepted record of the Nile. At a later period some of Ptolemy's theories were rejected, but the discoveries of Speke, Baker, and Stanley—seventeen hundred years later—largely vindicated the assertions of the Alexandrian writer, and proved him to have been a great geographer.

I will pass over the statements of such classical authorities as Pliny, Aristotle, and Seneca, regarding the Nile. Most of them shared Ptolemy's views. I will also dismiss the period subsequent to the Moslem conquest, with the remark, that certain of the Arab traders, between the ninth and fifteenth centuries, must undoubtedly have reached the lakes, and may possibly even have seen the Nile outfall.

Early in the seventeenth century, two Portuguese missionaries, Fathers Paez and Lobo, separately visited Lake Tsana and saw the sources of the Blue Nile. In 1786, the traveller Bruce made the same journey, and explored this river. He thus finally settled the question of its origin. Some six years earlier, a French geographer, D'Anville, published a map of the Nile and its basin. This contained the names of many rivers and localities, and, in spite of certain inaccuracies, was generally more correct than many maps produced at a later date.

During the first half of the nineteenth century, many travellers visited Egypt and the Sudan, and some of them added considerably to the geographical knowledge of the Nile. Among these may be mentioned Caillaud, Werne and Peney, and the Fathers of the Austrian Mission. None of these travellers, however, threw any new light upon the great question—that of the Nile sources—and the geographers of the time were inclined to disbelieve all existing stories regarding them.

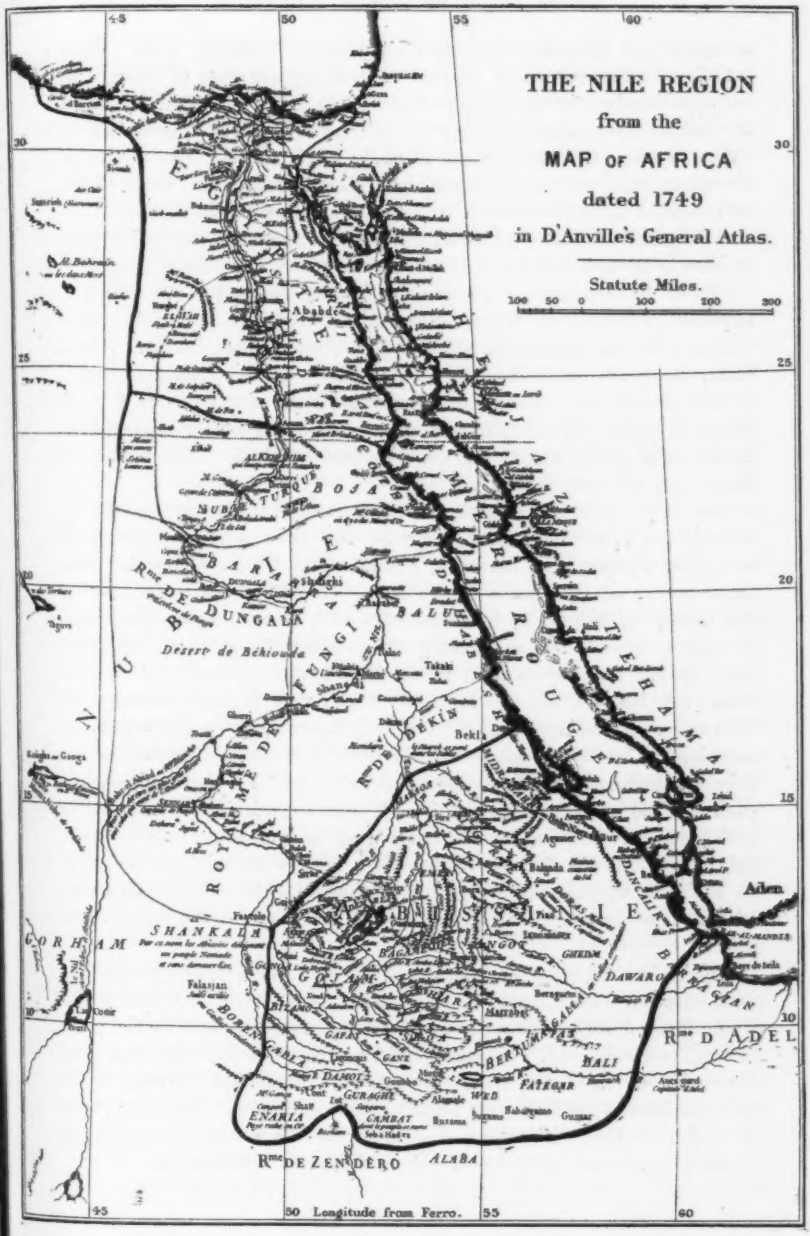
A change was, however, approaching. The honour of having brought this change about, and of having caused the interest in the

Nile sources to revive and bear fruit, is largely due to two German missionaries, Doctors Ludwig Krapf and Johann Rebmann. These two devoted men established themselves, in the forties, on the east coast of Africa. In their many conversations with the Arab traders from the interior, they, like the Greeks before them, heard accounts of vast inland seas and of great mountains, whose highest peaks were covered with a white substance—resembling salt in appearance. These stories eventually inspired them with the wish to penetrate the country in which these marvels lay. In this wish, however, they were actuated rather by the spirit of the missionary than by that of the explorer, and were chiefly moved by the desire to preach the gospel to the heathen inhabitants of these strange lands. They made their first attempt in 1845. In 1848, Rebmann saw the snowy peak of Kilimanjaro. A year later, Krapf enjoyed the same privilege, and also viewed, from a distance, the snow-crowned summit of Kenia. The accounts of their travels raised much criticism among geographers, and were generally discredited. England, as in the case of Bruce's journey, was foremost among the sceptics. It is pleasant to think that both Krapf and Rebmann lived to see their statements confirmed. They undoubtedly prepared the way for Speke's discovery, inasmuch as they proved that it was possible for an expedition, entering Africa from the east coast, to penetrate to the interior of the continent.

I now come to what I have called my first period of Nile discovery, namely, that comprised between the years 1856 and 1898. I think, on an occasion like the present, I may be excused if I devote a few words to the two remarkable men who led the vanguard in the army of the explorers of the Nile basin. Richard Burton and John Speke were both officers in the East India Company's army. Both of them had seen active service in India, and Burton had specially distinguished himself by his daring journey to Mecca and Medina, in the disguise of an Afghan doctor. Both of them were born in Devon—that county which has been the birthplace of so many bold adventurers and explorers. Although differing much in character, Burton and Speke possessed many qualities in common. Both were essentially masterful men. Both were born wanderers, and true sons of Ishmael. Both loved adventure for its own sake, and both soon wearied of the "clogs of civilization." The thoughts of both had turned to Africa long before either of them visited that country.

Their first attempt to enter it, through Somaliland, ended in disastrous failure. Upon this I will not dwell, nor upon their subsequent service with the Turkish contingent in the Crimea.

In 1856, on Burton's return to England, he pressed the question of Nile exploration upon the public. Thanks to the intervention of the Geographical Society, the British and Indian Governments were at length induced to furnish the necessary funds. Burton invited Speke


THE NILE REGION
from the
MAP OF AFRICA
dated 1749
in D'Anville's General Atlas.
Statute Miles.
100 50 0 100 200 300
45
50
55
60
30
25
20
15
10
Longitude from Ferro.
Désert de Bahiouda
Adem
ABYSSINIE
NUBIE
BARIA
DUNGALA
SHANKALA
GORHAM
ALABA
Rme DE ZENDERO
Rme D'ADEL

to again join him, and they left England in October, 1856. Upon arriving at the east coast, Burton—moved by accounts of dangers to be apprehended on the proposed route by Kilwa—decided to follow the beaten track from Bagamoyo to Kazé, the Arab trading-station in Unyamwezi—"the land of the moon." Here, for the first time, the travellers heard reports of a great lake, called Ukeréwé—far to the north, and distinct from the western sheet of water, upon whose shores Ujiji was located.* These stories sank deep into Speke's mind, and appear to have even then convinced him of the existence of a second lake.

After their discovery of Tanganyika, in January, 1858, the two explorers returned to Kazé. Burton was apparently satisfied that Tanganyika was the source of the Nile, but Speke had doubts. When, later, Burton's health broke down, Speke proposed that he (Speke) should travel north alone, and investigate the truth of the reports about the other lake. To this proposal Burton at last agreed—as Speke says, grudgingly. Burton remained at Kazé, while Speke set forth upon this new journey.

On July 30, 1858, he reached a large creek, running in a northerly direction. This creek proved to be the most southerly point of the great Nyanza. In his book, Speke says: "This, I consider, was *the* discovery of the source of the Nile." Marching northward along the creek, on August 3, he ascended a hill, and his eyes—weakened by exposure and disease—were gladdened by the sight of the great lake, spread out before him, in all its beauty. I cannot do better than quote his own words. He says: "The vast expanse of the pale-blue waters of the Nyanza burst suddenly upon my gaze. It was early morning. The distant sea-line of the north horizon was defined in the calm atmosphere, between the north and west points of the compass, but even this did not afford me any idea of the breadth of the lake, as an archipelago of islands, each consisting of a single hill, rising to a height of 200 or 300 feet above the water, intersected the line of vision to the left, while, on the right, the Western Horn of the Ukeréwé island cut off any further view of the distant water to the eastward of north."

Speke had achieved his quest, and his long and arduous search had been crowned with success. That moment must have been one worth living for, and must have amply compensated him for all that he had gone through and suffered. He was convinced from the first that this was the real reservoir of the Nile. He says: "I no longer felt any doubt that the lake at my feet gave birth to that interesting river, the source of which has been the subject of so much speculation and the object of so many explorers. The Arabs' tale was proved to the letter." †

---

* Lake Tanganyika.

† 'What led to the Discovery of the Source of the Nile,' p. 307.

Bound by his promise to Burton, Speke was obliged to retrace his steps, unable, as he says, to pluck the fruit that was almost within his grasp. Before returning, however, he collected—as was his invariable custom—a large amount of information from the natives, and he christened his discovery, the Victoria Nyanza, in honour of Her Majesty, the late Queen.

On August 25, he arrived at Kazé, after an absence of little more than six weeks. Burton objected to his statement—that he had discovered the source of the Nile—as tending to diminish the value of his own discovery of Tanganyika. A rift in the friendship of these two illustrious men thus started, which time but widened. It was only closed by Speke's untimely death, some years later.

Upon Speke's return to England, great enthusiasm was aroused by his discovery. Sir Roderick Murchison, then President of the Geographical Society, accepted all his views, and urged him to return to Africa and complete the task that he had begun. This Speke agreed to do. While the arrangements for his second journey were in progress, Burton arrived in England. A long and bitter controversy ensued between the two explorers, Burton maintaining that Tanganyika was the main source of the Nile, and asserting that the Victoria Nyanza was merely a collection of small lakes and swamps.

Speke started again for Africa, leaving the dispute unsettled. This time he was accompanied by a companion after his own heart—Captain James Grant—who, like himself, was an officer in the Indian Army. Grant was a man loved by all who knew him. Unselfish and chivalrous to an extreme degree, he was of determined character, and free from any shade of weakness or indecision. A sportsman, a naturalist, a botanist and an artist, he was exceptionally fitted for a task like that which lay before him. He rendered splendid service throughout the expedition, but, on his return, kept himself modestly in the background, preferring that the renown which resulted from the successful completion of the great enterprise should fall upon the shoulders of his companion and leader, rather than upon his own.

Time will not permit me to do more than very briefly describe Speke's second expedition.

The travellers started from the East Coast in October, 1860, and reached Unyamwezé in the following January. Here Speke again collected much information about the Nile from the native traders, and here he first heard of the existence of yet another lake, to the north-west of the Victoria Nyanza.* After harassing delays, and incredible difficulties, the expedition, in November, 1861, arrived at the capital of Rumanika, the Bahima ruler of Karagwé, a district lying to the west of Lake Victoria. Here, they were kindly received, and found

* This was Lake Albert.

themselves among a race of people differing entirely from the wild tribes among whom they had wandered for so many weary months. Here, they found a civilization far superior to any they had yet met with in Africa, and here, they were assisted, in place of being obstructed. After a two months' stay in Karagwe, Speke started northward alone, leaving Grant, who was seriously ill, behind him. He crossed the Kagera river—the Kitangulé of the Arab tales—and, marching parallel to Lake Victoria, he arrived at the capital of Mtesa, King of Uganda, in February, 1862. Here again, he was well received by the Baganda. The existing state of civilization—higher even than that of Karagwe—struck him forcibly, but the barbarity of the king's rule, and the daily executions that he witnessed, filled him with horror. He remained at Mtesa's court for some four months, being joined in the interval by Grant. Unfortunately, the latter's health again broke down, and Speke had again to set forth by himself. After a ten days' march, he arrived at the Nile, some distance below its outlet from Lake Victoria. Following its course up-stream, on July 17, 1862, he stood beside the beautiful cataract, where the river takes its first leap from the great reservoir that supplies it, and starts upon its long and troubled course to the north. To this outlet he gave the name of the Ripon falls, after Lord de Grey and Ripon.

Speke had now fulfilled his mission. He had proved that his theories were correct, and that the river of Egypt, whose birthplace had hitherto remained a secret from the world, did, beyond all doubt, issue from the lake that he had discovered four years earlier. The problem was solved at last, and his name was rendered imperishable. It is true that his latest discovery only settled a portion of the question, but that portion was a very important one. The inland sea, lying under the Equator and draining an immense area, was certainly the chief source from which the Nile derived its constant supply. Nothing could reduce the value of this discovery, and not even the possible future revelation of other sources could diminish its importance. It must not be forgotten that Speke himself, from the information given to him by the natives, was convinced of the existence of another lake to the west, and was assured, in his own mind, that it too was connected with the Nile.

Speke and Grant, in their return journey, followed the general direction of the Nile, but crossed the river at the Karuma falls, in order to escape from the country of Kamurasi, the King of Unyoro. Had they realized that at this point they were only some 50 miles from the junction of the Victoria Nile with Lake Albert, and had they followed the course of the river for a few marches, they would have still further sealed their fame by the discovery of the second source of the Nile.

On February 15, 1863, the two explorers reached Gondokoro, meeting Baker at that place. Speke gave Baker all his notes regarding the

second and undiscovered lake, known to the natives as Luta Nzige, or the Small Locust. This meeting led to Baker's journey, and to his discovery of the Albert Nyanza.

Speke and Grant returned to England in 1863. The sole reward accorded to the travellers for their labours by the British Government, was the permission granted to Speke, that he might add supporters to his coat-of-arms in the shape of a hippopotamus and a crocodile!

Immediately after his return, the old controversy with Burton recommenced, and gathered strength. The bitterness of feeling between the two men increased. It is needless to dwell upon this unhappy difference, and it is better only to remember, that they were both great Englishmen, and that both had rendered invaluable services to their country.

The results that Speke achieved constitute an immortal monument to his name, and one that all might covet. He must always stand in the front rank of those who devoted their lives to solving the question that had perplexed mankind for more than twenty-three centuries.

The next great figure that appears upon the scene is that of Samuel Baker. A man of magnificent physique and exceptional courage, Baker had, from early manhood, led a wandering life. He had hunted big game in many lands, before the fascination of Africa caught hold of him, and drew him to visit that mysterious country. Accompanied by Mrs. Baker, he landed in Egypt in 1861, with the intention of travelling up the Nile, and meeting Speke and Grant on their return journey. Having time at his disposal, he spent more than a year in the Eastern Sudan, hunting, exploring, and adding much to the knowledge of the tributaries of the Blue Nile. Starting from Khartum in the autumn of 1862, he, as has been related, met Speke and Grant at Gondokoro early in the following year. Speke's story of the possible existence of a second lake fired Baker with enthusiasm, and he determined to investigate the question for himself. He and his wife left Gondokoro in March, 1863. Baker was much obstructed in this journey by the slave-traders who infested the upper Nile valley; so much so, that he finally quitted the river and marched through the highlands of Latuka and Acholi. After many months of travel, he, like Speke, crossed the Nile at the Karuma falls. Here, Kamurasi tried to prevent his passage through his country, as he had previously tried to stop Speke, but, after experiencing exceptional difficulties, the travellers managed to work their way towards the lake, without an escort—through a hostile land—having lost all their medicines and most of their stores. Baker himself suffered severely from fever, and his heroic wife nearly died before the goal was reached. Nevertheless, they still struggled on, and on March 16, 1864—twelve months after their departure from Gondokoro—they reached the summit of the escarpment at Mbakovia. Here,

all their sufferings were forgotten at the sight of the beautiful lake lying far beneath them, the high cliffs and lofty mountain ranges that surrounded it forming a huge rocky cistern for its emerald-green waters. To his discovery, Baker gave the name of the Albert Nyanza, as the consort to Speke's Victoria lake. The travellers coasted along the eastern shore, to the north, in canoes—a sufficiently perilous voyage, on account of the severe storms to which Lake Albert is subject.

At Magungo, near the north-east end, Baker, struck by the existence of a wide, shallow, and reedy bay, forced his way through a dense growth of papyrus, and found himself on a large river, flowing into the lake from the east. Following this up, he at length arrived at the point where the Victoria Nile, tearing impetuously through a narrow rocky cleft—barely 18 feet across—thunders down, in a drop of 120 feet, into the basin below. These splendid falls he called after Sir Roderick Murchison. Baker had now completed what was wanting in Speke's researches. He had discovered the second great source of the Nile. He had also proved, almost beyond doubt, that the river which left the Victoria lake discharged its waters into Lake Albert. He had, at the same time, verified the assertion made by Ptolemy—that the Nile sources had their existence in twin lakes.

I will not occupy myself with Baker's return journey—down the Nile—to Egypt, although at times it was both difficult and dangerous. Neither will I do more than allude to his subsequent return to Africa in 1869, with the object of endeavouring to suppress the slave trade. During this last period, however, he ascended the Bahr el Zaraf, a loop of the upper Nile, and has given a graphic description of his difficulties with the "sudd" in that river.

Sir Samuel Baker left a reputation behind him, in Central Africa—throughout every region in which he travelled—that has hardly been equalled, and has certainly never been surpassed. His name, and that of Lady Baker, still lingers in the memory of the sword-hunting Arabs of the Eastern Sudan, as well as in the recollection of the negroes of the upper Nile. He was of the best type of Englishman, and made the name of England greater, wherever he went, by the impress of his just and manly character.

Two points have always struck me, in Baker's accounts of his travels, namely, the accuracy of his descriptions, and the foresight with which he argues upon the problems connected with the future control of the Nile. In my own wanderings in the Nile basin, I have invariably taken his books with me, and have always found them invaluable guides. Baker had a remarkably clear idea of the parts respectively played by the different lakes and rivers of the Nile system. To him must be accorded the distinction of having been the first to suggest the construction of dams in the northern cataracts, whereby the waters of

the river could be raised and stored, and the cultivated area of Egypt increased.

I now come to what is, perhaps, the most striking personality of all—in the roll of the discoverers of the Nile—that of Henry M. Stanley.

Unlike Speke, Grant, and Baker, Stanley was not a sportsman, nor was he, at first, a keen explorer. He was not, originally, drawn to Africa by a desire to investigate its unknown areas. By profession a journalist, his first visit to that continent was made in the interests of an American daily paper. The result of his search for Livingstone, however, inspired him with the desire—intensified later by the explorer's death—to revisit the country in which the great missionary had laboured for so long, and to endeavour to complete the work that he had commenced. The journalist was thus converted into an enthusiastic traveller.

Stanley was well fitted for African exploration. He possessed an immense fund of nervous energy, accompanied by a cool courage, which sustained him undismayed in the face of danger, and by a dogged resolution, which left him undeterred by the most stupendous difficulties. He was also a born leader of men.

When returning to England in 1874, after taking part in the Ashanti campaign of that year, Stanley received the news of Livingstone's death, and at once determined to devote himself to the completion of the task thus left unfinished. He soon succeeded in interesting others in his scheme, which was warmly taken up by the proprietors of the *Daily Telegraph* and the *New York Herald*, who organized and financed the new expedition. On November 17, 1874, he set out from Bagamoyo for the interior, arriving at the south end of Lake Victoria, in February of the following year. He circumnavigated the lake—in a boat that he had brought with him—and corrected the errors of Speke's map, as to its shape and area. He visited the Nile outlet, and proved that the Nyanza was a single sheet of water, and not, as Burton had asserted, a series of small, separate lakes.

On arriving at Mtesa's capital, Stanley, like Speke, was immensely impressed by the remarkable civilization, and the powerful military organization, existing in the Baganda kingdom. His acute mind quickly grasped the possibilities of Uganda as a centre for missionary enterprise. He realized that, if he could succeed in interesting Great Britain in such a project, a most important departure would have been made in the direction of introducing European civilization into Central Africa. His appeal, by letter, when it eventually reached England, aroused so much enthusiasm that an anonymous donor presented £5000 to the Church Missionary Society on condition that a mission should be started in Uganda. The first party of English missionaries started for Uganda in the spring of 1876. This, although not at the time realized, was in reality the first step towards the introduction of British

rule in Equatorial Africa. I will return to this subject later. Meanwhile, I will complete the relation of Stanley's discoveries in the Nile basin. His last voyage, and, in some respects, his greatest expedition, was undertaken for the relief of Emin Pasha—at that time cut off from communication with the outer world, but known to be still holding the Equatorial province, for Egypt, with a small force of loyal Sudanese troops.

The relief expedition started in 1887, under Stanley's leadership. He was accompanied by several Englishmen, and his force was the largest, and the best equipped, that had ever been despatched from Europe into the heart of Africa. This time, Stanley started from the Congo and, travelling up that river, struck eastward into the great forest which, covering many thousands of square miles, stretches across a portion of the Semliki valley and up the western flanks of Ruwenzori. In this area of primæval vegetation, he spent several months, passing days without seeing the light of the sun, owing to the density of the foliage overhead. On emerging from the forest, Stanley reached the valley of the Semliki, and in May, 1888, he discovered the mountain chain of Ruwenzori. On this memorable occasion, he had the good fortune to see the mists, which habitually envelop this grand range, roll away, and not only to obtain a panorama of the peaks, but also to view the dazzling whiteness of their snow-clad summits, piercing through the clouds that shrouded their bases. This discovery alone would have sufficed to have made his third journey famous. It was not all, however. After his meeting with Emin, he followed the Semliki valley to the point where this river issues from Lake Edward. Although Emin Pasha was the actual discoverer of the Semliki, Stanley was the first traveller to trace its course, and to prove that it connects the two lakes, and, consequently, forms a portion of the Nile system. When skirting the north end of Lake Edward, he recognized that he had really discovered this lake in his previous journey, although at the time unaware of the fact.

Stanley had thus cleared up the last great problem with respect to the Nile sources. He had proved that this river has two separate and distinct systems of supply. The one is Lake Victoria, fed entirely by the rainfall over its catchment basin; the other comprises the Edward and Albert Nyanzas—connected by the Semliki—deriving their supply, partly from rainfall, and partly from the melting glaciers of the Ruwenzori snowfields.

It is impossible to exaggerate the importance of Stanley's work. The main facts regarding the sources of the Nile were finally revealed by him, and nothing was left for future explorers but to fill in the details. This was a magnificent achievement for one man to have compassed, and Stanley must always stand out as having done more than

any other to clear up, and to correct, the errors in the geography of the Nile basin. I say this in no disparaging sense of the work done by Speke and Baker. They, between them, discovered the two main sources of the river, and their discoveries perhaps thrilled the world even to a greater degree than did those of Stanley. These two explorers, however, by force of circumstances, left the work unfinished. Stanley not only completed it thoroughly, but added largely to it by his own remarkable discoveries. To him also it was due, as I have already pointed out, that the first English mission was despatched to Uganda.

Here I will leave him. It would be foreign to the subject of this paper were I to describe his work in the Congo basin. On that river, he did almost as much for geography as he did on the Nile.

It is necessary for me now to go back a little, and say something of the opening up of the country between the Victoria lake and the sea-coast—what is now known as East Africa. Although only a portion of this area actually lies within the Nile basin, some allusion to its exploration must be made, as I could not otherwise explain how England eventually drifted into the Protectorates of Uganda and of East Africa.

After Krapf and Rebmann, the first traveller who made an important advance into the interior by the Mombasa route, was Dr. Fischer—like them, a German. In 1882, he reached Kilimanjaro, and was the first European to visit Naivasha. This is one of the lakes in the Great Rift valley; that remarkable fissure which, formed by the sinking of the Earth's crust, runs in a north and south direction for several hundreds of miles.

Before Fischer's return to the coast in 1883, an English expedition, organized by the Royal Geographical Society, had left Mombasa with the object of reaching the Equatorial lakes by the most direct route. This expedition was led by Joseph Thomson, whose name must always rank very high as a successful African explorer.

Thomson passed through Masailand and, after encountering appalling difficulties, arrived at Naivasha. He then travelled northwards along the Rift, but his difficulties, due to the hostility of the natives, and to want of supplies, increased instead of diminishing. It was only by a happy chance that he escaped with his life. He discovered Lake Baringo, and proved that it had no connection with the Nile reservoirs. Thence, he marched to Lake Victoria, striking it in the Kavirondo district, in the north-eastern corner. On his return journey, he nearly fell a victim to the climate, and was badly injured by a wounded buffalo. It was with much difficulty that he was able to reach the coast.

Thomson may with justice be called the pioneer of the Uganda railway.

Two and a half years later, a Hungarian, Count Samuel Teleki, started from Zanzibar with the object of traversing East Africa, and visiting the unknown lake, called by the Arabs, Sumburu, and said to be located in the north-east. Teleki's journey was a remarkable one. The difficulties that he encountered were stupendous, and would have caused most men to abandon the enterprise. He overcame them all. He made a partial ascent of Mount Kenia, and was the first to enter the unexplored country of the Wa-Kikuyu. Following the Rift valley to Baringo, he eventually discovered Lakes Rudolf and Stefanie. These two lakes are situated in the dreary volcanic region north of the Rift, and adjacent to the south-western frontier of Abyssinia. By Teleki's expedition the last of the great African lakes was discovered.

Before I describe how the British East Africa Company came into being, I will complete my account of the progress of Nile exploration, during what I have termed my first period. I regret that want of space prevents me from mentioning more than a few names, in the long list of those who have distinguished themselves by seeking to complete the world's geographical knowledge of the Nile.

Between 1853 and 1864, Petherick, a trader, made several voyages to the Bahr-el-Ghazal and its southern affluents. Between the years 1859 and 1864, Mademoiselle Tinné, accompanied by the naturalist Von Heuglin, also explored that river. This gifted but ill-fated lady, murdered some years later in North Africa by the Tuaregs, has given her name to one of the large lagoons, near the junction of the Gazelle river with the White Nile. This lagoon is still called by the Arabs "Mayyeh Signorina." Between 1868 and 1871, Prof. George Schweinfurth investigated the Eastern desert, and afterwards remained about a year in the Bahr-el-Ghazal province. He carefully explored this area and a small part of the upper Congo basin. His account of his travels forms a most valuable addition to the geography, botany, and natural history of every locality that he visited.

During the same period, Gordon Pasha—who had succeeded Baker as Governor-General of the Sudan—did much in the direction of mapping the upper Nile. Two young officers of the Royal Engineers, attached to Gordon's staff—Lieuts. Watson and Chippendall—made a detailed survey, and produced an excellent map of the White Nile from Khartum to Lake Albert. Gordon also despatched Gessi Pasha and Mason Bey, at different periods, to navigate and survey the Albert Nyanza, while the Austrian Marno, with his support, did some useful work in the marsh country. In 1874, Colonel Chaillé Long explored the Victoria Nile and proved, beyond all question, that the river which entered the Albert Nyanza, at Magungo, was identical with that which issued from Speke's lake at the Ripon falls. Colonel Long was also the discoverer of the reedy lakes known as Choga and Kwania, called by him Lake Ibrahim.

Between 1875 and 1886, Wilhelm Junker carried out extensive journeys in Central Africa, ascending the Sobat river, and making careful researches in the Bahr-el-Ghazal and neighbouring districts.

Emin Pasha—then an officer in the Egyptian service—made the Nile basin his home for eleven years, until, in 1888, he was relieved by Stanley. During this period, he rendered much service to science, by his careful studies of the country in which he was so long resident. Emin revisited Equatorial Africa in 1890, accompanied by Stuhlmann, but was murdered by the natives two years later.

Dr. Felkin also, in his wanderings through the Upper Sudan, collected a large amount of valuable information regarding the waterways of that area.

Between 1890 and 1897, the officers of the East Africa Company, employed in Uganda, made many surveys of this region, and corrected the existing maps. During the same period, the traveller, Scott Elliot, visited Ruwenzori, and Captain Marchand started on his remarkable journey from the French Congo. Marchand followed the course of the Jur (or Swei) and the Bahr-el-Ghazal. He arrived at Fashoda, on the White Nile, in 1898. The surveys and reports made by the officers of his expedition, constitute a valuable addition to the physiography of this little-known area of the Nile basin.

Many other names could be cited, did space permit. I must, however, proceed to what is one of the most important portions of my subject, namely, the acquisition by Great Britain of a large area of Central Africa, and the partition of the continent between the Powers of Europe.

I have already explained how, in 1876, Stanley's crusade resulted in the despatch of a party of English missionaries to Uganda. The mission was well received by King Mtesa and, at first, all went smoothly. Two years later, the situation was entirely changed by the arrival at the capital of a Roman Catholic Mission—a branch of the White Fathers of Algeria. A deplorable rivalry at once commenced between the native representatives of the two creeds. Both parties appeared to forget the real object of their mission in their struggles for political influence. Matters were made worse by the Mahommedans and the Pagans joining in the fray. The melancholy spectacle was thus apparent, of four different religious factions, each fiercely striving to gain influence with the king, and each violently abusing the proceedings of the others. After Mtesa's death in 1884, his son, Mwanga, commenced a persecution of the native converts to Christianity. Bishop Hannington's murder in 1885, brought things to a crisis. The missionaries retired to the south-west of the lake, and by the middle of 1887 not a European was left in Uganda. At this point, I must make another digression, and explain how the East Africa Company came to be formed.

For many years previous to 1884, British influence was supreme in the dominions of Syed Bargash, the Sultan of Zanzibar. These dominions included the entire "Hinterland" of the East African coast. The entire trade was in the hands of Indian merchants. In 1877, by the influence of Sir John Kirk, the Sultan issued a decree, abolishing the slave trade throughout his sultanate. Sir John Kirk then proceeded to confiscate the slaves of these Indian traders, who, of course, were subjects of Great Britain. Once deprived of their slaves, these men had no further inducement to seek Arab protection, and a hold was secured over them that greatly strengthened England's position in the country. The commerce of this region then passed into the hands of an English trading firm — the British India Steam Navigation Company. Of this company, the late Sir William Mackinnon was chairman, and Mr. (now Sir) George Mackenzie was one of the guiding spirits.

In 1884–5, important political events took place. Germany, debarred from colonial expansion in almost every other direction, cast its eyes upon Africa, and entered the field as a competitor for the acquisition of territory in that continent. This was soon followed by the meeting of the Berlin Conference. Previous to this, the German flag had been planted on both the eastern and the western coasts, and the interests of Germany and Great Britain had become conflicting. A diplomatic contest between the two countries ensued. This struggle was ended by the agreement of October, 1886, whereby an arrangement was arrived at between the two Powers, and a line of demarcation was agreed upon, behind which each country was to retire. This line started from the mouth of the Umba river, and ran generally north-west to the eastern shore of Lake Victoria, in lat. 1° S. The only important deviation made was where the line turned northwards for a distance sufficient to permit of Kilimanjaro being included within German territory.

Shortly after the signature of this treaty, Sir William Mackinnon acquired certain rights for his company over the territory comprised in the British sphere of influence. On September 3, 1888, a Royal Charter was granted to this society, which then assumed the title of the British East Africa Company. Its administrative rights, as accorded by the charter, extended not only over East Africa, but over Uganda. Some further disputes with Germany subsequently arose, but were settled in 1890 by a new agreement, and Dr. Carl Peters's invasion of East Africa, and his attempt to seize the entire region for his own country, ended abortively. From the date of this agreement (a provision of which was the cession of Heligoland to Germany) the company was left in undisputed possession of the territory granted to it by the charter.

I will now return to Uganda, and describe the situation there. In

1890, the missions returned to Mtesa's capital, and fighting recommenced as actively as before. Both parties implored the Company to intervene. These demands resulted in the despatch of Messrs. Jackson and Gedge to Uganda, and the signature of a treaty by the king, whereby he ceded his kingdom to the company. This treaty, however, caused no abatement in the struggle for supremacy between the different factions, and on Lugard's arrival, at the end of 1890, he found the factions quarrelling with greater fury than ever.

Sir Frederick Lugard is well known as an exceptionally strong and able administrator, but the task of pacification was too strong even for him. At last, Lugard had recourse to the expedient of enlisting the remnant of the Sudanese soldiers, who had followed Emin in his retreat from the Sudan, and who were located, under Selim Bey, in the vicinity of Lake Albert. With this force, Lugard found himself strong enough to restore order; but, meanwhile, the company—aghast at the magnitude of the undertaking upon which it had embarked—decided to withdraw from Uganda, and notified its intention to the English Government, as well as to Lugard. The withdrawal was postponed for a year, but the prestige of the company had been shaken by the rumour, and the strife between the Catholic party and the Protestant party recommenced. In January, 1892, the Catholic party was completely defeated, after a series of engagements, by the Protestant party, aided by Lugard and his assistant, Major Williams. In the same year, a vigorous agitation was started in England, in missionary circles, for the British occupation of Uganda. The Government, although strongly opposed to the idea, found the pressure of public opinion too strong, and, in the beginning of 1893, Sir Gerald Portal was directed to visit Uganda and report upon the advisability of retaining or evacuating it. Portal, finding on arrival that retention was inevitable, if a war of extermination was to be avoided, hoisted the Union Jack in Uganda, and hauled down the company's flag. He enlisted further Sudanese troops, and, when he left the country, placed Captain (now General Sir) J. R. Macdonald in charge. Macdonald was an officer of the Royal Engineers, who had carried out the survey for the proposed Uganda railway. After Portal's departure, fighting again broke out, and the different Bahima princes were soon actively engaged in making war upon one another. The arrest and deportation of Selim Bey, for alleged treason, exasperated the Sudanese soldiers, and did not make matters any easier. After Macdonald's departure, Sir Henry Colvile, who succeeded him, found himself obliged to conquer and annex the kingdom of Unyoro.

In June, 1894, it was announced in Parliament that England had decided to take over, and administer, both Uganda and East Africa. In the following year, the Chartered Company, after seven years of existence, was bought out by the English Government.

Protectorates of both countries were then formally proclaimed, and England assumed responsibility over an area of more than 400,000 square miles, and over a population estimated at some eight millions.

Even this, however, did not at once restore tranquillity to Uganda. The unfortunate mutiny of the Sudanese troops, in 1897—due to a number of grievances, more or less legitimate—threatened to seriously imperil the position of the British in Uganda. This rising cost some thousands of lives, and retarded for many years the prosperity of the country. With the defeat of the mutineers, and the deportation of the most notable of the rebellious kings, peace settled upon the Protectorate—after some twenty years of constant warfare. The railway from the coast to the lake, commenced in 1895, was rapidly pushed forward. Separate commissioners were appointed to Uganda and to East Africa, and the members of the rival missions agreed to settle their differences and to live in harmony with one another. Since that time, the missions have rendered noble service to the cause that first brought them to the country, and have largely assisted in bettering the condition of its inhabitants.

In bringing this, my first period, to a close, I wish to lay stress upon the fact that England's acquisition of this large territory was the direct consequence of Speke's discovery, nearly forty years before. His great exploit first raised English interest in Equatorial Africa, an interest intensified by the results of his second expedition. Baker's journey to Lake Albert was due to his meeting with Speke at Gondokoro, and his discovery of the second source of the Nile still further increased the public desire that the exploration of its basin should be completed. Stanley's second voyage was undertaken with this object in view, while the despatch of missionaries to Uganda, in response to his appeal, settled the eventual fate of a large portion of the continent. Joseph Thomson's travels through East Africa, to Speke's great lake, proved the practicability of the Mombasa route, and led to the construction of the Uganda railway. Lastly, Stanley's glowing accounts of the fertility of the land of the Baganda encouraged British commercial enterprise, and originated the formation of the Chartered Company. As we now know, the inevitable sequence was the English occupation of the country.

I now come to my second and last period of Nile exploration and study. It commences with the overthrow of the power of the Khalifa and the reconquest of the Sudan by an Anglo-Egyptian force in 1898. Lord Kitchener's victory at Omdurman resulted in fresh responsibilities for Great Britain, as, by the Convention of 1899, an area of nearly 1,000,000 of square miles was annexed, conjointly, in the names of the Sovereign of England and the Khedive of Egypt. I need say little here as to the causes of the Dervish rebellion; they were natural

enough. Although religion was made use of by the leaders to excite a naturally fanatical race, the real origin of the movement was the revolt of a people driven to desperation by some sixty years of misgovernment. The rebellion commenced in 1883, and culminated in the fall of Khartum and the death of Gordon, in 1885. In consequence of the abandonment of the Sudan by Egypt and the withdrawal of the Egyptian forces, for the next twelve years, all study of the Nile, south of the new frontier at Wady Halfa, became impossible. During this period, those in Egypt, charged with the control and distribution of the waters of the river, were seriously handicapped in their efforts, by the thick veil that had settled down upon the upper Nile, and by the absence of any information that could assist them in forecasting either the height and duration of its floods, or the amount of water that would be available in summer for the cultivation of the cotton crop.

With Lord Kitchener's victory, this veil was torn aside, and advantage was at once taken of the fact by the Egyptian Government. A comprehensive study of the hydrography of the Nile, throughout its entire course, was commenced, and has been continued up to the present day. With this study I have been somewhat intimately connected, and I venture to assert that, although the main facts concerning the river sources and the geography of its basin had been collected previous to 1898—by the explorers whose names I have recorded in this paper—a larger amount of valuable information has been compiled regarding it, in the last decade, and a more precise knowledge of the complex system that governs its supply has been acquired, in the same period, than existed prior to the date in question. I do not pretend that this knowledge is, in any sense of the word, complete. Far from it. Very many details are still wanting, more particularly as regards the tributaries of the main stream. It is, moreover, unnecessary to remark that, before it is possible to pronounce with assurance upon the deductions that have been already made, it is imperative that the scientific observations, commenced in 1899, should be continued and registered for a long period of years. Nevertheless, I think the time is not very far distant, when so much will be understood regarding the flow of the river, that the great projects, now under study, for still further utilizing its waters, may be put in execution without any undue risk of failure being incurred. In all these projects the Sudan is equally interested with Egypt. To the former country, prosperity, upon a large scale, can only return by the development of its agricultural resources.

I regret that the space at my disposal does not permit me to give any but the briefest description of this wonderful stream. To describe it satisfactorily would fill a volume. The Nile is a river of contrasts. In portions of its course, the scenery is ravishingly beautiful; in others, melancholy and desolate to an extreme degree. Witness, for instance,

the sterile region, honeycombed by the cones of extinct craters, that adjoins Lake Edward. The weird atmosphere of this lonely lake—for half the year shrouded in a dense grey canopy of mist—is intensified by the silence that reigns. This silence is rarely broken, except by the lapping of the waves upon the shore, or by the cry of unseen water-fowl. These surroundings are in striking contrast to the wild grandeur of those met with at Lake Albert. There, the air is generally so clear that not only are the mountain-ranges that encircle it plainly visible in all directions, but even the torrents that dash down their precipitous faces can be distinguished—their foaming cascades resembling white threads upon a dark background.

Again, the scenery of both these sheets of water contrasts vividly with that which characterizes the Victoria Nyanza in fine weather. On this lake, the clusters of wooded islands that break its broad expanse, the ever-changing lights that play upon its surface, and the low rounded hills that border its shores—all contribute to form a scene of calm loveliness. The Semliki, too, presents a diversity of river-scenery. At times it traverses wide, grassy plains—the home of innumerable antelopes; at others, it hurries down through deep valleys—sweltering in a damp, tropical heat and covered by impenetrable forest—above which the noble mass of snow-clad Ruwenzori dominates the landscape.

No one who has had the privilege of visiting those spots where the Nile encounters serious obstacles to its course is ever likely to forget their beauty. At the Ripon falls, for instance, the dark-green foliage, the bright-red cliffs, the indigo-coloured water, streaked with foam, and the blue sky overhead, combine to form an enchanting picture. At the Murchison falls, again, the wild accessories, the leap of the stream into the deep abyss, the continual roar of the imprisoned water, and the rainbow that ever plays upon the high-tossed spray, all create memories that linger long in the mind of the observer. At the Fola rapids, the sight witnessed is perhaps even more impressive. At this point, almost the entire volume of the river rushes down a long slide, between vertical rocky walls—through a passage barely 40 feet in width,—into a cauldron of white, boiling, and foaming water. The whole is an exhibition of the force and power of that element that can but rarely be seen.

Take, again, that long troubled reach, north of Khartum, where, for many hundreds of miles, the Nile traverses the great desert, its course barred by a continual succession of reefs and rocky islands. Here, its channel is hemmed in between narrow gorges and high cliffs, occasionally surmounted by the ruins of old fortresses, dating from the days of the Bosnian soldiery, and irresistibly recalling the castles of the Rhine.

All of these scenes present a remarkable contrast to those met with in the region of the great marshes. Here, the character of the river, and

of the landscape, abruptly changes. The rocky bed, the high banks, the heavy slope, and the sparkling water all disappear, and are replaced by a muddy bottom and a wide, shallow channel, winding between partially submerged and reed-covered banks, in a succession of loops and bends which recur with maddening regularity.

If the White Nile is distinguished for the diversity of its scenery, the contrast with that of the Blue Nile is even more complete. This river tears down from the Abyssinian highlands, through a marvellously beautiful country—a land of forest-clad hills and torrential streams—in a deep canyon, several thousand feet below the general surface-level. After about half its course is run, it enters comparatively open country, but its stream is still rapid, and its banks are high and densely wooded. The landscape is picturesque and wild, the vegetation is luxuriant, and the bird-life that throngs both the river channel and the adjacent forests adds a special charm to its scenery.

The waters of the Blue Nile, too, when the river is low, are remarkably clear and limpid. At such seasons, they reflect the sky in a sheet of brilliant blue. When in flood, they are turbid—heavily charged with deposit, and of a deep chocolate colour. At all times, they contrast with the waters of the White Nile, which contain little or no sediment, and which throughout the year preserve a tint of greenish grey.

To one portion of the region traversed by the Nile, I must devote some words of special description. I mean that of the great swamps, in which the remarkable weed-barriers occur; forming those blocks to its flow, that are known by the name of "sudd." Through this region the White Nile wanders for nearly 400 miles. It enters these marshes a fine river, with a considerable discharge. It issues from them a comparatively insignificant stream, having lost, by evaporation in the swamps, and by the absorption of the water-plants, from fifty to eighty per cent. of the supply that it brought down from the lakes. These marshes are of varying width; from 5 to 20 miles. At one point, opposite Ghaba Shambé, the latest surveys show that the flooded area east of the river is not far short of 30 miles in breadth. No one who has not seen this country can have any real idea of its supreme dreariness and its utter desolation. To my mind, the most barren desert that I have ever crossed is a bright and cheerful locality by comparison with the White Nile marshland. Dead flats extend everywhere to the horizon, unbroken by a single landmark, except, perhaps, an occasional stunted mimosa, or, where the swamps narrow, a line of tall "Deleb" palms in the far distance. Dark green hedges of tall papyrus bound the river channel on either side. Although these reeds, when in thick masses, possess a certain gloomy beauty, yet, when mile after mile of river is passed without any change in the character of the scene, this beauty is apt to pall and become monotonous. The air is, at all times,

steamy and hot, and the whole region is melancholy to an indescribable degree. This melancholy is intensified to the traveller, at sun-down, by the attentions of myriads of mosquitoes, which make their presence unpleasantly felt. These attentions they continue, without any relaxation, until the sun reappears above the horizon. Very few water-birds, beyond occasional night-herons, are met with in this portion of the river. Even the hippopotamus seems to shun it, and the crocodile alone appears to consider it a desirable haunt.

The "sudd" blocks in the Bahr-el-Gebel are generally caused as follows (I am now speaking from my own experience and observation, as, in the year 1900, when returning down the river with Major Peake, my steamer was imprisoned for three days and nights in the "sudd"):—

The Bahr-el-Gebel marshes are intersected by wide and shallow lagoons, connected with the river by narrow inlets. These lagoons, or "Mayyehs," as they are called by the Arabs, form nurseries for the different water-plants found in this locality. In such sheltered spots, nourished by the hot damp atmosphere, these plants grow luxuriantly. They are but insecurely anchored to the bottom, however, as their roots do not penetrate the mud to any great depth. In the rainy season, when strong winds prevail, the water-level in the lagoons at times rises slightly. Such a rise often causes large areas of vegetation to break loose from their connection with the bed. Floating islands are thus formed, consisting of the plants themselves and the earth adhering to their roots. Some of these islands are several acres in extent. During the stormy period, they get broken up, and portions drift—through the inlets, or by breaking through the papyrus hedge—into the river, and are carried down by the stream. A sharp bend, or a projecting shoal, is sufficient to arrest them, and they become stationary. Other masses follow them, and are similarly arrested, until the river surface is covered right across. The section of the channel is thus contracted, and the velocity of the current passing below is thus increased. Any succeeding masses of "sudd," brought down by the stream, are, consequently, sucked beneath the surface-block, which is thus rapidly augmented in thickness. With each subsequent addition, the sectional area, through which the river passes, is further contracted, and the compression of the block is increased. In a comparatively short time, a solid mass, composed partly of earth and partly of the broken stalks and roots of the reeds, crushed by the severe pressure, is formed in the channel. This mass is sometimes many feet in thickness. Underneath it the river rushes with a high velocity. In the instance of which I was a witness, the block thus formed was some 15 feet in depth, and more than 500 yards in length. Had it not been for the fortunate arrival of a steamer from the north, which was able to attack the obstacle from downstream, it is difficult to say for how long a time we might have been imprisoned, as

it is impossible to successfully attack the "sudd" blocks from the up-stream side.

The original block had been nearly removed, when another large area of grass and reeds broke into the river above it. In little more than half an hour, the channel was blocked as badly as before.

The only practical way of removing the "sudd" is that which was employed by Major Peake, when engaged in clearing the river, in the year 1900. Many other methods were tried, but none proved so successful as that which I shall describe. The reeds growing on the surface of the block were first burnt. Curious to relate, although green, these plants burn readily. Trenches, forming a rectangle about 10 feet square, were then dug to as great a depth as a man could reach. A wire hawser was then attached firmly to one of these blocks, and it was hauled out by the steamer downstream—going full speed astern. The released block was then allowed to float down the river. Successive blocks were thus removed, until, at length, the area of the obstacle was so largely reduced, that its solidity was insufficient to resist the pressure of the water upstream, and it broke up. The pent-up water burst forth with violence, carrying the remaining masses of "sudd" with it. The breaking of the block that I saw, reminded me forcibly of the descriptions of the bursting of the ice-fields in the far north, with the advent of summer. The ice-floes, in this instance, were represented by the broken "sudd" masses.

I have dwelt at some length upon this subject, because the question of keeping the Upper Nile channel permanently free from "sudd" blocks, and the prevention of the present loss of water in the marshes, are two of the most important of the problems that have to be dealt with in the future.

I propose now to briefly describe the point to which our present knowledge of the Nile has arrived, and to still more briefly allude to the projects under consideration for the better control and utilization of its waters.

I will begin by relating the parts which, as our studies have taught us, are played by the lakes, and by the several streams whose waters combine to form the Nile system as a whole.

Commencing with the Blue Nile, Lake Tsana, although actually the origin of this river, does not materially affect the volume of its discharge, as the quantity of water issuing from the lake, even in the rainy season, is insignificant as compared with the amount that the Blue Nile draws from other sources. The main factors upon which its flood-supply depends, are the drainage of its own valley in the mountainous region, and the additional water brought in by its affluents, such as the Didessa, the Yabus, the Dinder, and the Rahad.

In the case of the White Nile also, the influence of the Equatorial lakes is less than was at one time supposed. The discharge over the

Ripon falls is considerable, and varies, it is true, with the height of the water-level of Lake Victoria; but the regulating effect of the large reedy lakes of Choga and Kwania, through which the Victoria Nile passes, is so great that the volume of the river, as it issues from these sheets of water, is practically constant throughout the year. I do not mean to say that the supply brought into Lake Albert by the Victoria Nile is a constant one. Downstream of Lake Choga, several tributaries help to swell this river, and the rainfall in the lower portions of its valley is considerable. Consequently, there are large variations in the discharge entering the western lake. These variations, however, are not due to the rise and fall of the Victoria Nyanza.

The Albert lake plays a very different part. It is the true reservoir of the Nile, inasmuch as it receives the waters of both systems of supply. It is, at the same time, the regulator of the river, and the level of its waters largely dominates the volume passing down the Bahr-el-Gebel to the north. I say it largely dominates this volume, but it does not do so altogether, or at all times. During the period of heavy rainfall, a considerable addition is made to the Nile discharge by the numerous torrents that feed it, between the outlet from Lake Albert and the point where it enters the marsh country. At the same time, the Bahr-el-Gebel, like the Victoria Nile, is subject to a regulating force. This force is the effect of the great marshes, already described, which so waste and evaporate its water, that the supply, eventually issuing from them and arriving at the White Nile, is practically a constant one at all seasons of the year.

I will now proceed to show how the annual rise of the Nile is produced, and how the constancy of its supply throughout the year is maintained. In the months of April and May, the torrents, which aliment the Bahr-el-Gebel, are at their lowest, if not actually dry, and the discharges of the Blue Nile and the Sobat have shrunk to very small limits. At this period of the year, then, practically all the water passing Khartum is that derived from Lake Albert. In June, the Blue Nile begins to rise slowly in consequence of the Abyssinian rainfall. About the same time, the Sobat discharge into the White Nile begins to increase. In July, the floods in both the Blue Nile and the Sobat increase very rapidly, and in the month of August, they attain their maximum. The Atbara, too, at this period, is in full flood, and brings a large addition to the volume of the Nile north of Khartum.

As the Sobat rises, a curious thing happens. I have already explained that, in consequence of the regulating effect of the swamps, the discharge of the Bahr-el-Gebel into the White Nile is a small but constant one. The larger volume of water rushing out of the Sobat, consequently, holds the smaller volume back and prevents it from passing on. A reservoir is thus formed in the White Nile channel, upstream of the junction, which cannot discharge itself until the Sobat levels have

again fallen. At this time, the Sobat water takes the place of that derived from the lakes, and it is this river that—from July to October—produces the entire volume of water passing down the White Nile channel to Khartum. During the month of July, then, the flood water reaching Egypt is derived entirely from the Sobat, the Blue Nile, and the Atbara. The supply coming from the equatorial lakes, as I have explained, is held back and stored in the river valley, upstream of the Sobat junction. In the month of August, occurs one of the most interesting phenomena connected with the Nile system. The Blue Nile is then in full flood, and attains to a volume some ten times as great as that brought down from the Sobat by the channel of the White Nile.

The Blue Nile now plays an exactly similar part, with regard to the White Nile, although upon an infinitely larger scale, to that which I have described the Sobat as doing to the Bahr-el-Gebel. As soon as the Blue Nile discharge at Khartum exceeds a certain volume, the flood holds back entirely the waters of the White Nile, ponding them up and forming an immense reservoir, which floods the White Nile valley for nearly 200 miles. This ponding up is maintained until the Blue Nile discharge again sinks below the volume above mentioned. This generally occurs in September. Immediately this happens, the impounded water in the White Nile is set free, and passes on to the north. As the Blue Nile discharge decreases, which it does rapidly, and the fall in that river commences, its place is taken by that of the White Nile. In consequence of the large amount of water stored in the reservoir, the discharge of the latter river at Khartum increases steadily until the end of the year. Meanwhile, the Sobat has also been rapidly falling, and the water, stored in the smaller reservoir to the south, passes down the White Nile and helps to maintain its supply. In November, when the Sobat has fallen very low, the lake water, brought down by the Bahr-el-Gebel, again becomes the main supply of the White Nile. The amount of water, however, held up by these two reservoirs, is so considerable that, throughout the early winter months, the volume passing Khartum is actually greater than that which comes down from Lake Albert, diminished as it has been by the loss caused by the great swamps.

To those who do not know the Nile, and have not studied its discharges, it is difficult to explain this wonderful arrangement, whereby these rivers automatically compensate one another, so that, at the time when one system is passing on a large volume of water, the other is storing up its discharge, and, when the former begins to decrease in volume, the stored water takes its place and makes good the deficiency.

The comprehension of these facts is, I consider, one of the most important results of our studies of the Nile since 1898.

I will now say a few words about the principal affluents of the Nile.

The Bahr-el-Ghazal, the chief western tributary of the White Nile, plays but an insignificant part in the general system of supply. Throughout its lower course it crosses the natural fall of the country, instead of following it. Consequently, its slope almost disappears. So flat is it, indeed, that when the Sobat holds back the White Nile discharge, the waters of this river stand back in the Ghazal valley, and the levels are affected at Mashra er Rek, some 120 miles above the junction.

A considerable amount of water runs off the catchment basin of the Bahr-el-Ghazal, and, in the upper portion of its course, the streams that supply it are large and rapid rivers. The water that they bring down, however, is largely lost and evaporated in the horrible marshes through which the Bahr-el-Ghazal passes, for the last 200 miles, or more, of its course. The feeders of the river in this last area are all sluggish streams, flowing in reedy ditches like itself, and their waters also lose themselves entirely in the swamps. The so-called Bahrs-el-Arab and el Homr, of the older maps, are not, as was formerly supposed, distinct rivers, rising in southern Kordofan. They are one and the same stream, of which the name differs in different localities, and which is the outfall of a net-work of swampy channels, coming from the south-west, which cross and recross one another in a bewildering labyrinth.

The Bahr-el-Zaraf, the eastern loop of the Bahr-el-Gebel, has no other source of supply than the "mountain river" itself. It collects the drainage of the marshes to the east of the Bahr-el-Gebel, its main feeder being a large channel rising in the swamps north of Bor. This channel, which is simply a collector for the drainage of the marshes, is Grogan's "Gertrude Nile," now called by its Dinka name, the Atem. This drainage line skirts the high land on the east, and eventually divides into two branches, both of which disappear in the swamps. Their waters, however, reappear in the Zaraf, further south. The Bahr-el-Zaraf acts as a relief-channel to the Bahr-el-Gebel, when that river is blocked by "sudd." It merely returns to the White Nile the water that it has drawn from the Bahr-el-Gebel, less the large amount lost and evaporated in the marshes.

The Sobat, as I have explained, for about half the year, acts a very important *rôle* in the supply of the White Nile. It is a true mountain river, running in flood, bank full, with a swift current. Its waters are derived mainly from the south-western plateau of Abyssinia, but it is also fed by the Pibor, a swampy stream which skirts the base of this plateau for a long distance. It is just possible, but this point has not yet been settled, that, during the rainy season, a certain amount of the water in the large "Khors" mentioned by Baker as flowing northward from the Latuka hills, may find its way across the intervening plains into the Pibor. It seems far more probable, however, that these streams lose all their water in a series of marshes, behind the ridge that borders the eastern swamps of the upper Nile. The water of the Sobat, when

in flood, has a creamy-white tinge, and to this fact the White Nile doubtless owes its name.

Of the rivers which feed the Blue Nile, only the Didessa, and perhaps the Yabus, are perennial. Little is as yet known regarding either of these streams. They have been crossed by several travellers, but neither has as yet been traced to its source. The Rahad and the Dinder have been thoroughly explored. Each of them brings down a large volume of water in flood, but at other times they are dry.

The same remarks apply to the Atbara, which, however, takes a prominent part in the causes to which the annual flood-rise of the Nile are due. Its discharge, at the maximum, is very considerable, only second to that of the Blue Nile. Its waters at this time contain more deposit than those of any other river in the Nile system. In summer, except for a few pools, the bed of the Atbara is dry.

The foregoing remarks summarize the conclusions arrived at, after several years of continuous study, by the officers employed by the Egyptian Government. In the prosecution of these studies many have taken part. It is impossible for me to mention here the names of all those who have assisted in this work. I will content myself with giving two. The first is that of a distinguished member of this Society; Captain Lyons, Director-General of the Egyptian Survey Department. He, in conjunction with Colonels Talbot and Pearson, of the Sudan Service, has been for many years engaged in mapping the Nile. The maps thus produced are the most correct, and up to date, yet published. He has also occupied himself, ever since our scientific observations of the Nile were first commenced, in recording and tabulating all information thus collected, and in reducing it to an intelligible shape. He has, further, given the results of his own deductions to the world, in a series of interesting papers.

Mr. Dupuis, too, the Inspector-General of Irrigation in the Sudan, has contributed largely to a fuller knowledge of the river and its affluents. An immense amount of survey and levelling has been carried out by his staff during the last few years. These surveys, when completed, will assist in a better understanding of the hydrography of the Nile.

He has erected a series of permanent gauges on both the Blue and White Niles, throughout the limits of the Egyptian Sudan. The water-levels of these rivers are now daily recorded, and a register of the highest importance is thus kept. In the winter of 1902-3, Mr. Dupuis visited Lake Tsana, and the Settit and Atbara rivers. He prepared an excellent report upon his journey, which has been published.

Many of the officers in the Sudan Service have rendered great service to geography, by their surveys of, and excellent reports upon, such outlying portions of the Nile basin as they have visited in the course of their duties.

Without the assistance, however, of Sir Reginald Wingate—assistance that has always been given in the fullest sense of the word—it would have been impossible for the engineers and surveyors, in those wild and remote localities, to have accomplished anything like what they have succeeded in doing, in such a comparatively short space of time. Geographers owe a debt of gratitude to the Governor-General of the Sudan, for his interest in, and his constant help to, our studies of the Nile basin during the last nine years.

The authorities of the Uganda and East Africa Protectorates, too, have always lent us every possible assistance. They have spared no pains to collect for us such facts as we required, and have invariably given every facility to our officers whenever they have visited either country.

Besides the work carried out by the Egyptian officials, much has been done since 1898 by other explorers and travellers. The list of those who have thus laboured is a long one. I can only give a few of the more prominent names. Sir Harry Johnston, by his studies of the equatorial lakes and rivers, by his ascent of Ruwenzori, and by his monumental work upon Uganda, must always take a high place among those who have added to the geographical knowledge of the Nile basin. The journeys of Dr. Kandt, and those of Messrs. Grogan, Gibbons, and Dècle, have rendered similar service. The same may be said of the travels of the late Captain Wellby—from Lake Rudolf to the Sobat—and of Majors Austin and Bright's expedition to the same region. Major Gwynn has explored and mapped the Sobat sources, and Commander Whitehouse has made a triangulated survey of the north coast-line of Lake Victoria. At a more recent date, Messrs. Butter, Baird, and Maude have surveyed the little-known frontier between Abyssinia and Uganda. Messrs. Donaldson Smith and Neumann have travelled through the north-eastern portion of the upper Nile basin, and collected much information regarding it. Mr. Moore has explored Lake Albert Edward. Colonel Delmé Radcliffe has made an excellent survey of the Bahr-el-Gebel, between Lake Albert and Gondokoro, and has, more recently, been in charge of the English party engaged in the delimitation of the Anglo-German frontier. On the Blue Nile, Mr. Weld Blundell and Mr. Crosby have added considerably to our knowledge of the upper portions of that river, and of its western tributaries. Within the last two years, the Duke of the Abruzzi and Dr. Wollaston have successfully ascended Ruwenzori, and made clear much that was previously unknown regarding that mountain range. More recently still, Major Bright and the officers of the Congo Free State have investigated the Semliki throughout its entire length. Perhaps the most memorable journey of all has been that made by Lieut. Boyd Alexander—from the Niger, through the great forest, to the Nile valley. This journey has resulted in one of the most interesting books of travel ever yet published.

In addition to work resulting from actual travel, much literature has been produced within the last ten years. In German East Africa, the authorities have devoted much attention to the study of the southern portion of the Nile basin, and to the correction of the existing maps of that region. Sir William Willcocks has written more than one book, containing a large amount of important information regarding the Nile, while Captain Lyons's latest work—a compilation of all previous reports and writings upon the same subject—must constitute a valuable aid to those who wish to seriously study the physiography of this river.

In the way of real exploration, not much now remains to be done. Many details are still wanting, and a large amount of local survey still remains unaccomplished. The main facts, however, are now known. The filling in of the blanks yet remaining on the map is only a question of time. Among the localities as yet unsurveyed, I would instance that lying west of the Bahr-el-Ghazal. A network of swampy streams traverse this tract. To the east of the Bahr-el-Gebel again, in the expanse of country comprised between the northern hills of the Latuka range and the Sobat, and extending east to the Pibor and Akobo rivers, large areas are as yet untraversed. The country south-west of Roseires, and between that place and the Sobat, is still practically unknown.

But little, as I have already said, is known concerning the Didessa and the Yabus, both important tributaries of the Blue Nile, while, so far as I am aware—although Mr. Weld Blundell's latest survey has practically fixed the alignment of the Blue Nile valley—no traveller has as yet succeeded in actually following the course of this last-named river, from its source in Lake Tsana, to the point where it crosses the Abyssinian frontier at Fazogl. Lastly, a correct survey of the area of Lake Edward is still wanting.

I think that we may look back upon the work accomplished, during the last fifty years, with satisfaction. As regards the Nile basin and valley, at all events, Kipling's lines—

> "The last and the largest Empire,
> The map that is half unrolled,"

no longer apply. The map is very nearly open now.

In addition to the increase of the geographical knowledge of the Nile basin, made since Speke's discovery, the material progress of the countries comprising that area has been equally marked, within the same period of time.

British administration in Uganda and East Africa has encouraged trade in those protectorates, and has brought both countries a long way upon the road to prosperity. The only cloud upon the horizon now is that caused by the ravages of the deadly sleeping sickness. The Sudan has emerged from barbarism, and, under the wise rule of Lord Cromer and Sir Reginald Wingate, has made a steady advance in the direction

of security and well-being. Throughout the Nile basin, the slave trade has practically disappeared, and, if it exists at all, only does so in a few isolated localities. A railway now connects the equatorial provinces with the sea coast, and in the Sudan, many hundreds of miles of line exist, while the Blue and White Niles are being bridged, with a view to further railway extension. A fine harbour, capable of admitting the largest ships, has been constructed on the Red sea, and is joined by a line of railway to the great waterway of the Nile. The main telegraph lines, throughout the entire area, have been completed, and Khartum is now in telegraphic communication with all the more important posts in the Sudan, and also with Cairo and Uganda. Egypt, too, under Lord Cromer's guidance, has left bankruptcy far behind, and is now in a state of financial stability that many European powers might envy. The waters of the Nile have been made full use of to increase the agricultural wealth of that country, and irrigation works have been carried out that have largely conduced to the phenomenal prosperity now existing.

The Delta barrage, restored by Sir Colin Scott-Moncrieff, some eighteen years ago, has played an important part in adding to the riches of the Egyptian landowner. Since then, three other similar barrages have been constructed at different points in the Nile valley. The great dam at Aswan, which has already repaid the cost of its construction several times over, is now being raised in height. This work, when completed, will enable a quantity of water to be imprisoned upstream, two-and-a-quarter times as great as the amount at present stored, and will give perennial irrigation to another million acres of land in Northern Egypt, now lying waste. On both the Blue and the White Niles, projects are in course of preparation, that will, if executed, still further add to the agricultural wealth of both the Sudan and of Egypt. The utilization of Lake Tsana, as a storage reservoir for the Blue Nile, has, for the present, at all events, been abandoned, on account of political reasons. It is now proposed to construct a regulating dam in that river, within Sudan territory, and, by raising the water-levels, supply a great canal, that will irrigate the rich alluvial tract known as the Ghezira, during the autumn and winter months. This canal will eventually enable some 3,000,000 acres to be cultivated with wheat and cotton.

On the White Nile, the most urgent problem to be solved is the prevention of the present loss of water in the marshes. When this is done, the supply drawn from Lake Albert will reach Egypt in summer, undiminished in quantity. The "sudd" in the Bahr-el-Gebel was cleared away by Major Peake, and others, between the years 1900 and 1902. The entire channel is now free to navigation, but the waste of water in the swamps is as great as ever. To remedy this, several projects are under consideration, but much further information and study are still

required before a selection can be made. Meanwhile, powerful dredgers have been ordered, with a view to experimenting on the best method of increasing the waterway. Should the result of such a project be successful, the entire remaining area, in Egypt, now under basin cultivation, will receive the benefit of perennial irrigation. Lastly, the River Gash, that impetuous and intermittent torrent of the Eastern Sudan, will shortly be controlled and regulated, by a series of works, so as to permit the fertile province of Kassala to reap the fullest advantage from its floods.

One more point is worthy of mention in the record of progress. To my mind, among the most striking results of English administration in the Nile basin, during the last ten years, are the marvellous facilities that now exist for locomotion. Ten years ago, the traveller, in the Sudan or in Uganda, had no other means of transport at his disposal than the camel, the donkey, the native porter, or the canoe. Now, through a considerable part of both countries, he can, if he travels by land, make use of a *train de luxe*, provided with every modern appliance, or if by water, in a comfortable steamer. Again, it is remarkable how, in the last few years, postal communication has been abridged. Khartum is now within eight days of London, the Victoria Nyanza and the Nile outlet within a month. When I remember my first visit to the upper Nile in 1899, and the state of things then existing, I find it difficult to realize how rapidly all these changes have been effected. The above merely gives an outline of the progress that has been made. I venture to assert that it constitutes a splendid record. These results have only been attained by much labour and self-sacrificing effort on the part of those who have been instrumental in obtaining them. Many valuable lives have been lost in the struggle, the toll exacted by the Nile God for the invasion of his sanctuary.

I feel confident that in the future, as in the past, Englishmen will always be found ready to bear their share in the great work—commenced by Speke, and carried on by Baker, Gordon, Stanley, and their successors—of completing our knowledge of the Nile, of endeavouring to improve the material condition of the inhabitants of its valley, and, at the same time, bestowing upon them the blessing of good government.

These are tasks worthy of comparison with any that have been recorded in history, and which, if accomplished, even in part, will constitute a monument to the work of the great explorers, worthy of their names, and more enduring than any of those erected by an earlier civilization in the valley of the Nile.

The PRESIDENT (before the paper): My first duty is to read the following letter from Lord Cromer:—

"DEAR MAJOR DARWIN,—

"If, as I fear will be the case, I should be unable to attend the meeting to-night, I shall be very much obliged to you if you will express to the

meeting how greatly I regret my enforced absence. I have had the advantage of reading a proof of Sir William Garstin's paper. The only criticism I have to make upon it is that with characteristic modesty he has scarcely done justice to himself. The discoverers—Burton, Speke, Baker, and others—showed us what the Nile was. It required the help of a highly trained hydraulic engineer to turn the discovery to account.

"As has so often happened in the history of our country, when the occasion arose the man was forthcoming. He was Sir William Garstin. It is impossible for me to speak too highly of the services rendered by Sir William Garstin in Egypt and the Sudan, and I very greatly regret that I cannot be present to testify my high appreciation of those services.

"Very sincerely yours,
"CROMER."

The PRESIDENT, introducing the speaker, said that on July 30, 1858, the celebrated explorer Speke first saw the waters of Victoria Nyanza, and thus solved the riddle of the Nile, a riddle which had puzzled geographers for many centuries. It was certainly a jubilee which ought not to be forgotten for many reasons. In the first place, Speke's discovery was one of the greatest geographical achievements of that century—a century so full of striking geographical events. When that discovery was made it was impossible to foretell that it would have more importance to the United Kingdom than to any other European country, because at that time our connection with the Sudan, Uganda, and Egypt was hidden in the mists of the future. At present we could not forget that the Nile—that mighty river—and nearly all its tributaries passed through countries which were under British dominion, or where our political influence was predominant. Then, again, the discoveries were made by Englishmen—he said Englishmen, because there were many names which ought to be mentioned besides the great name of Speke. They ought never to forget the name of Burton, because he was, after all, the leader of the expedition from which Speke was detached when he made his great discovery. Then there was Grant, who would always be remembered, because he was the faithful companion of Speke in his subsequent journeys. Among those who completed those earlier discoveries the name of Stanley must be mentioned. Another reason for celebrating this event was that the Society was instrumental in sending out those expeditions by which the riddle of the Nile was solved.

Sir COLIN SCOTT-MONCRIEFF: I was not the least prepared for this to-night. I think I may truly say that in this large room there is no single person less of an explorer than I am. But I am sure I have enjoyed very much the interesting lecture given by my dear old friend and colleague Sir William Garstin. It has been a great pleasure to me to hear it. For myself, what can I say? Supposing a foreigner came, we will say, from Russia to England, and learned something about the Thames between Gravesend and Greenwich, would he be justified in going back to Russia and giving a lecture on the Thames? That is the kind of feeling I have. Sir William Garstin has said that for twelve years the Nile was closed to all knowledge—it was during nine of these years that I served in Egypt. I have sometimes thought it a little difficult for people to realize what is the meaning of so many thousand miles. Supposing by some great convulsion of Nature the river Thames should find its way into the Euphrates, and so out into the Persian Gulf, that would be just about the length of the river Nile. To give another comparison: the country watered by the Nile, that is the country commonly known as Egypt, being the narrow strip of the Nile valley from the second cataract to the Mediterranean sea, about 900 miles, that country is only about one and a half times the size of Wales. It is a narrow small valley. Every yard of it is cultivated, and

with all that science can effect it will never be a very large area, the levels of the two sides of the valley prohibiting any great extension of cultivation.

The PRESIDENT: I do not know whether Sir John Dorington would care to say a few words.

Sir JOHN DORINGTON: I did not expect to be called upon to address this audience when I received the honour of an invitation from the Geographical Society in order to celebrate the Jubilee of Speke, fifty years since he made his great discovery. I married into the Speke family, and knew him well between his first and second expeditions; I knew him after his return from the great success of the Victoria Nyanza. I was rather surprised to hear this evening that there was at any time any doubt at all about the levels of Tanganyika rendering it impossible for the waters of Tanganyika to reach the Nile. Speke had no doubt of that kind at all. If any confidence was to be placed in the boiling temperature registered by thermometers, it was quite certain the waters could not go to the Nile, because through the Austrian missionaries at Gondokoro, we knew very well what the Nile levels were there. He was equally confident that the water he found at what is now the south end of the Victoria Nyanza rendered it highly probable that it went to the Nile, and to prove this was the object of his second expedition which could never have taken place if it had not been for the cordial support that Sir Roderick Murchison and this Society gave to his enterprise. Money and influence was given to him to enable him to start on that expedition which he carried through so well. Although he had a guard of forty men recruited in Zanzibar, armed, and to a certain extent disciplined, and notwithstanding all the perils that he passed through in that long journey for something like three years, he never fired a shot in anger, nor was any outrage committed by any of the men under his control. I remember how we were startled, when we got the telegram from Khartum, "The Nile is settled." It is rather remarkable, that if the sudd had existed in those days as it exists now, Speke might never have reappeared. He could not have waited six months between Gondokoro and Khartum. He never could have outlasted that time, but probably would have perished in those swamps, and we should have known nothing more until Baker returned. How is it, I should like to know, that this sudd trouble, which has been so great of late years, was never apparently encountered by the Austrian missionaries, and has only occurred since the days of Speke—I think he took three weeks from Gondokoro to Khartum. Sad indeed was his death, in the full possession of his faculties, an enterprising and resolute explorer, and suddenly cut off by an accident out shooting. It was a sad termination to an illustrious life. I knew Grant also well, and a more devoted companion and friend no man ever could have had than Speke had in Grant. I am glad to hear that MRS. Grant is here to share the credit of the enterprise which has been celebrated to-night by the Geographical Society. I thank the Royal Geographical Society very much for having brought back again to the recollection of the world how the discovery of the Nile was made.

Colonel Sir C. M. WATSON: Sir William Garstin's paper has brought back very forcibly to my mind this day thirty-four years ago, when I was on the upper White Nile, or, to speak more correctly, on the Bahr-el-Gebel, at that place which Sir William Garstin showed you a photograph of, measuring the width of the Nile and surveying the river; therefore you can understand that to me this paper is of special interest. There are one or two points I would like to refer to. I do not think Sir William Garstin laid sufficient emphasis on the work which General Gordon did himself. General Gordon had great characteristics, as we all know, but people are not aware that he was a most painstaking and accurate surveyor, and that he was the first to make a really good survey of the Victoria Nile from the

Albert lake to the Murchison falls, and the Karuma falls, as far as Nyamyongo on the northern borders of Uganda. There is another point concerning him also that I would like to mention. We have heard something about the East African Company and the opening up of the country from the East Coast into the interior, but I think it should never be forgotten that Gordon was the first to propose to open up that route from the East Coast. He realized most fully the difficulties in keeping up his communication with Egypt by that long river, 3000 miles in length, and he considered whether it would not be possible to open up a route from the East Coast of Africa to join the headquarters of the Nile. He wrote a letter to the Khedive, proposing he should send an expedition to Mombasa, to march into the interior and meet a force which he proposed to send down. That expedition was sent by the Khedive. Gordon's idea was that they should go up the Tana river, which Sir George Mackenzie, whom I am glad to see here, knows very well, and that they should join hands with him in the districts to the north of Uganda. The expedition was sent, but for some reason I have never been able to understand, instead of being sent to the Tana river, they were sent to the mouth of the Juba river, which, of course, was no use for opening up communication with the Nile; but, at the same time, the English Government sent to the Khedive to tell him to order his expedition back to Egypt as quickly as possible, because he had no right to interfere with the territories of the Sultan of Zanzibar. Though his proposal came to nothing, we must not forget the share Gordon had in the proposition for opening up the district from the East Coast to the Nile. As regards the White Nile, I would like to say that Sir William Garstin's description of the river is very accurate; it is a very dull and dreary district—in fact, it is almost worse than a London fog. You see nothing but these reeds round you day by day, and it is very difficult to get through on account of this sudd. It is a curious fact that during the time Gordon was administrator of the country, the sudd gave no trouble at all. It was cut through before he went there, and it never closed again until after he had left, and I believe the reason was this, that Gordon was most careful in always keeping up the communication by steamer with Khartum. His theory was that if you could keep one steamer a month going between Khartum and Gondokoro the sudd would not have time to form, and certainly it was proved that his theory was correct, because during the time he was there sudd never formed, but it was not till after he left that it re-formed and entirely stopped the navigation. Gessi, whom Sir William Garstin has alluded to as having made the first survey of the Albert Nyanza, was stopped by this sudd on his way back to Khartum, and of about five hundred men who were with him, no less than four hundred died of starvation on account of the sudd. He got out, but was so utterly broken by the starvation that he died when he got to Suez. That was, I think, the greatest loss of life, due to this terrible sudd, on record. I have kept you too long; and I would only like to express to Sir William Garstin my sincere thanks for this most interesting paper, which perhaps we, who know the Nile by personal experience, can best appreciate.

Mr. FRESHFIELD: I respond, sir, to your invitation not without diffidence, for I have no claim to be enrolled in the noble army of martyrs who, as pioneers of religion or of knowledge, have revealed to us the heart of the Dark Continent. I am rather one of that happy band of pilgrims who are carried in a first-class carriage in forty-eight hours across the 700 miles of wilderness which took our forerunners three months' hard travel to overcome. The Uganda railway has opened the Nile lakes to Cook's tourists, and even brought them within the long vacation tour of a Cabinet Minister. On that great achievement we in this Society may look with particular pride, for the initial step in the planning of the railroad was the journey of Joseph Thomson, and that journey was paid for by the Society and planned

by the foresight of our Council. Thomson's instructions were to seek the shortest way to the great lake, passing between Mounts Kenia and Kilimanjaro. Our Council had grasped the fact that here lay the true key to the control of the Nile sources and much of the commerce of Central Africa.

The African traveller now starts not from the coast, but from the farther shore of Lake Victoria. The region he has to traverse is in many ways a friendly one. Wherever you go in Africa, it seems, unless you aim at virgin peaks or virgin forests, there is a path. I remember how, many years ago, I took Sir H. Johnston up a small but steep Alpine hill. As the zigzags steepened he halted and exclaimed, "Thank heaven, there is nothing like this in Africa." I confess I was puzzled at the time; but now I have been to Africa I quite appreciate the truth of the saying. The dangers and difficulties of African travel are, as a rule, not those of the road. I met a missionary, a padre, travelling with a choice of four modes of progression, a donkey a litter, a bicycle, and his own legs.

My main object, however, to-night is not to generalize on African travel, but to call attention to two points Sir W. Garstin has in the press of matter passed over. The first is the exceptional character of Ruwenzori and its singular position as regards the source of the White Nile. Its range, some 70 miles long and reaching to a height of nearly 17,000 feet, has no connection with any great water-parting. It rises in the middle of the western rift, like an island, or rather like a peninsula, united only at its north-eastern extremity by a relatively low isthmus (about 5000 feet) to the verge of the Uganda highlands. I would ask you to sit with me in imagination on that sudden verge, only an hour's ride from Fort Portal.

At our feet, 3000 feet below, the Semliki falls into the bosom of Lake Albert. Opposite us on its further shore, cape beyond cape, rise the Blue mountains of Beber. (It is a mistake to suppose he saw Ruwenzori. On the south and south-west he saw a water-horizon.) Beside us Ruwenzori juts its rugged lines on to the burnt plain of the Semliki. Behind us lie grassy downs dotted with pools (crater-lakes) filled with blue water-lilies. The water from these pools will flow right round Ruwenzori, first south down the depression on its east flank, through Lakes Ruisamba and Lake Albert Edward (or as, with the King's permission, we may henceforth call it, Lake Edward), and then back north along the Semliki valley till it passes again beneath us to Lake Albert, having made, in a course of nearly 200 miles, the complete tour of Ruwenzori, and gathered up every stream from its forests and its snows to feed the Nile. Of this snowy mother of the Nile there has been a steady tradition through the ages. It has been reserved to our time to prove this tradition well founded. There may be, there are I believe, people who still prefer to think that when Ptolemy wrote of the Nile rising from a snowy mountain, he was simply romancing. There is nothing like the credulousness of incredulity.

I come now to my second point. In his admirable report on the Nile basin. Sir William Garstin has done justice to the scenery of the farthest of the Nile lakes, Lake Edward. But to-night he has obscured its fame. He has spoken of it "as a lonely lake, eternally shrouded in a dense grey canopy of mist"! I once met on the hills of Carrara an Italian sailor who told me he had been in England, "a Londra, dove fa sempre nero"—where it is always night. That is a parallel case of too hasty generalization.

I spent nearly a week on the shores of Lake Edward. I never saw it in a mist. When the rains on Ruwenzori are clearing the air, when the tropical thunderstorms are flying over the waters, the lake enjoys a singularly transparent atmosphere which displays to perfection its noble scenery, for its scenery is noble. I shall not forget the first view of the lake from the grassy downs that lie under Ruwenzori—a sheet of pale-green water stretching away 30 miles or more to where the cones of the

Mfumbiro volcanoes fringed the southern horizon, while on our right steep mountains clothed in green up to their summits sprang abruptly from the shore, and on their upper slopes the smoke columns of native fires rose here and there against a brilliant blue sky. Next I wandered round the cheerful banks of the north-east bay, banks fringed with tropical blooms, as the Thames is with eglantine in June; fishing canoes darted in and out among the islands; a pair of huge white cormorants floating on the surface looked as if they had been put in by a painter to add value to the colours of the landscape. And then, mounting a flowery hill, I looked down on the further side on the broad channel which carries all the eastern waters of Ruwenzori to the lake—when we saw it, a noble river flowing between high banks clothed in tall-stemmed, bright-blossomed trees, over the tops of which rose the blue line of the Ankole uplands. When Mr. Winston Churchill fulfils his promise, and carries on the railroad to Lake Albert, let us hope he will not forget to put a steamer on Lake Edward. It will pay in more senses than one. It is time the British flag was seen on those waters. Finally, Sir Wm. Garstin has expressed a wish for the exploration of the course of the Semliki between Lake Albert and Lake Edward. Surely this has already been accomplished, in great part if not wholly, by Stanley and Dr. Stuhlmann, and more recent travellers and Belgian officials.

Mr. G. F. Scott Elliot: It is many years since I visited those slopes of Ruwenzori. There is nothing so beautiful in the world as a view over that limitless plain. You may perhaps see a flight of locusts rising far away in the distance, and one can watch them getting nearer and nearer till at last the great mass of them fall on the trees of the forest and you hear the branches break under their weight. There is one point that I should like to know, where is the water which evaporates from these Nile marshes carried to? Is the general direction of the wind towards Ruwenzori, or is it towards the Congo region or to Abyssinia?

The President, in bringing the discussion to a close, said that there were two reasons why he had dwelt especially on the names of Speke, Burton, and Grant. In the first place, this was the jubilee of Speke's great discovery. In the second place the Society had been instrumental in promoting both the Burton and Speke, and the Speke and Grant expeditions. The sums of £750 and £2500 had been granted out of their funds to these two expeditions, though it is true that in each case the money was eventually refunded by the Government. A doubt cannot but be felt whether the Treasury would have been so generous if the expeditions had been failures, and the Society appears to have incurred at least a considerable risk on each occasion. Geography is not usually considered to be one of the moral sciences; but certainly a moral can be plainly drawn from the events discussed to-night. Burton was first in the field in the search for the great lakes; but when by good luck it fell to Speke to actually make the great discovery, Burton unfortunately did not realize its true magnitude, and sought to minimize his work. Speke naturally then felt at liberty to take independent action, with regard to his second expedition. In that second expedition, Speke was accompanied by a man, Captain, afterwards Colonel, James Grant, who never thought of his own reputation, and who consequently won an exceeding bright one. The geographical moral of this story is, that not only is generosity to other explorers right in itself, but also that it pays best in the long run.

THE PANAMA CANAL IN 1908.*

By VAUGHAN CORNISH, D.Sc., F.R.G.S., F.G.S., F.C.S., M.J.S.

HAVING first visited the Canal Works at the beginning of January, 1907, I decided to make a careful study of the undertaking, but the work was interrupted by the earthquake which I experienced at Kingston on the 14th. The investigation of this phenomenon occupied me for the rest of the year, and it was not until 1908 that I was able to resume the study of the Canal Works. For this purpose I visited Washington, and made application through the proper channel to the Department of State, who kindly consented to further the inquiry. I proceeded then from New York to the Isthmus by the R.M.S.P. *Magdalena*, arriving at Colon April 12, 1908. Here Colonel Goethals, chairman of the Isthmian Canal Commission, provided me with a letter to those concerned to furnish all information, and proposed that I should make my way about unattended, and pursue my inquiries independently, which I did. I spent rather more than a fortnight on the Isthmus, daily inspecting the works and interviewing the *personnel*, and I shall always look back on this time as one of the most interesting and delightful in my life. Alike for the student of science and of affairs, there is at present no place more interesting than the Isthmus of Panama.

The locus of the canal is the central line of a strip 10 miles wide, called the Canal Zone, which extends from the Bay of Limon on the Atlantic to the Bay of Panama on the Pacific ocean, and for about 3 miles seawards in both oceans, the group of islands in the Bay of Panama being also included therein.

The occupation and control of the Canal Zone has been acquired by the United States in perpetuity from the State of Panama, a republic, constituted in 1904, whose independence is guaranteed by the United States.

By the Hay-Pauncefote treaty of 1901 between Great Britain and the United States, it is enacted that the proposed canal shall be open on equal terms to the ships of war and commerce of all nations, both in time of peace and in time of war. The canal, however, although in this sense neutral, is national, not international. It is to be operated solely by American citizens, fortifications are to be erected, and its defence will be undertaken by the army and navy of the United States.

The unfinished works of the French companies having been acquired

* Read at the Royal Geographical Society, November 30, 1908. Illustrated by photographs by the author. Map, p. 240.

by purchase, and the treaty with the Republic of Panama having been ratified, the Americans started work in June, 1904.

Sanitation on the Isthmus.

In July, 1904, Colonel W. C. Gorgas, M.D., took charge of the Department of Sanitation, which he has administered ever since to the great benefit of all concerned.

Natives of the Zone and West Indian negroes are immune from yellow fever, but this swiftly fatal disease has invariably broken out on the Isthmus when a large number of non-immune strangers have gathered there. An outbreak occurred in April, 1905, and soon produced a panic which threatened to bring the whole undertaking to an untimely end.* Heroic measures were adopted; the force of the Sanitation Department was increased to four thousand men; the city of Panama was cleansed and fumigated house by house, the *stegomyia* mosquito which propagates the disease was exterminated, and the epidemic ceased. Finally, the city of Panama was provided with a proper water-supply, was brick-paved, sewered, and plumbed, and there has been no return of the disease. Similar measures have been taken in Colon.

Anopheles, the mosquito of malaria, which breeds on fresh water where grass and algæ grow, is prevalent all across the Isthmus; whereas the yellow-fever mosquito is chiefly confined to the neighbourhood of towns. Protection from malaria is afforded by housing employees in buildings screened by copper gauze, and by oiling or draining stagnant waters. The final method is subsoil draining,† for open channels are liable to be temporarily blocked, forming pools in which water remains stagnant sufficiently long for the larvæ to be deposited and hatched. By these means, and by the supply of quinine, malarial fever has now been so far reduced that it no longer seriously hampers work.

In 1907 the total death-rate among employees from all causes, including accident, was—

	Average number.	Total deaths.	Annual death-rate per thousand.
White employees	10,709	179	16·71
Black "	28,634	953	33·28
Total	39,343	1,132	28·77

* *Vide* 'I.C.C. Annual Report, 1905,' p. 30; and Colonel Gorgas on "Sanitation in the Canal Zone," *Journ. Am. Med. Assoc.*, July 6, 1907, vol. 49.

† Until the Lincolnshire fens were drained *malaria* was common in that part of England, where it was known by the name of ague.

During the same period, among 1337 American women and children in Commission quarters there occurred nine deaths, an average of 6·73 per thousand.

Modern science, in conjunction with a despotic government, for such in fact is the Canal Commission, has proved equal to the task of tropical sanitation on the Isthmus.

On the Type of Canal.

While the doctors were fighting the battle of sanitation, the Government of the United States was engaged upon the almost equally anxious task of deciding whether the canal was to be tide-level or high level. The Isthmus of Panama is so hilly that, unless by tunnelling, a shipway can only be constructed by following as far as possible the river valleys. That of the Chagres leads from Colon for 26 miles directly towards the Pacific ocean. At or near Bas Obispo the course of the valley abruptly turns, running parallel to the coast. A distance of only about 9 miles separates this place from the low valley of the Rio Grande, which leads directly to the Pacific. This is the route chosen for the canal. But where the upper Chagres meets the line of the proposed canal its surface is 46 feet above tide-level in the dry season, and sometimes 80 feet above during floods. If, therefore, a tide-level canal be made, the waters of the Chagres must either be directed into another channel or controlled in their passage through the canal. In either case the difficulty of the task is much enhanced by the sudden floods to which this considerable river is subject. The same remarks apply to the other rivers on both banks of the canal and on both sides of the divide. The original scheme of De Lesseps would have involved practically three waterways, of which the middle one would have been for navigation, and it would for a great part of its course have been threatened by the higher waters of the artificial river-channels on either side.

The tide-level scheme of the majority-report of the Board of Consulting Engineers appointed by President Roosevelt was different. They recommended a dam at Gamboa to control the upper waters of the Chagres. Their flow through the canal would be so regulated that the currents would not prevent navigation. Other dams and some diversion channels would be made to control the lower waters of the Chagres and other rivers. The Gamboa dam, dealing with the upper waters of the Chagres, was, however, the salient feature of the scheme. It was admitted that the tide-level canal would cost more and take longer to build than a high-level canal, but it was claimed that it would have (in addition to the other advantages entailed by the absence of lift-locks) the great merit of being less liable to damage and obstruction in case of hostilities.

The disadvantage of slow construction was considered, however, to be fatal, and the Administration accepted the view of other experts that

the time estimated by the majority of the Board was inadequate for the completion of the tide-level canal, and that the currents would be a source of trouble. Considerations of cost appear to have had less weight than that of delay, but account was also taken of them and they were also against the tide-level scheme.

In 1906, therefore, an Act of Congress was passed sanctioning the 85-foot-level scheme. By the previous "Spooner" Act of 1902, it was enacted that the canal should be such as would provide a passage for the largest ships built or such as might reasonably be expected to be built. Thus the depth of the canal and the dimensions of the locks had necessarily to be much greater than had been contemplated in the high-level scheme which was the later scheme of the French engineers.

The salient feature of the 85-foot-level scheme is the great dam which is to pond back the lower as well as the upper Chagres and all its tributaries in the manner shown on the map. The "Lake Gatun" thus formed will have an area of 164 square miles, *i.e.* twice that of the Lago Maggiore. By means of this dam the streams will be tamed, and a waterway provided which will be broad and easy of navigation for many miles.

Unfortunately, however, the site for the dam, and all other possible sites for such a dam, do not admit of a foundation on hard rock. The Gatun dam is not only to be itself composed of loose material, but is founded partly upon clay and partly upon sand and gravel. The Gamboa dam, on the other hand, would have been founded upon hard rock and could have been built up therefrom in solid masonry, thus forming part and parcel of the stony framework of the globe itself.

The High-level Canal as it is to be.

From shore to shore the canal is 41 miles long, but to reach deep water 4 miles must be dredged at either end, so that the whole length is 49 miles; of this about 9 miles has to be excavated in hard rock.

The Spooner Act, the law under which the canal is being constructed, enacts that it shall be "of sufficient capacity and depth as shall afford convenient passage for vessels of the largest tonnage and greatest draught now in use, and such as may reasonably be expected." Accordingly, the following dimensions have been selected:—

First, a minimum depth of 41 feet.

Secondly, a minimum bottom width of 200 feet in the Culebra cut.

Thirdly, each lock will have a usable length of 1000 feet and a width of 110 feet.

Fourthly, the minimum radius of the curves is 5577 feet (1700 metres).* This curve, however, does not come in the Culebra cut

* *Vide* p. 205 of Gen. Abbot's 'Problems of the Panama Canal' (1907). Slight changes in the projected course are made from time to time, so that this figure is subject to some modification.

SITE OF GATUN LOCKS AND DAM, LOOKING WEST.

LOCK SITE AT GATUN, LOOKING NORTH.

where the bottom width is to be 200 feet, but north of Bas Obispo where the bottom width is 500 feet. Most of the curves have a radius of 9842 feet (3000 metres).

A reference to the accompanying map will show that most of the curves are situate in Gatun lake, where the width of the canal proper is large, and where the spread of shallower waters secures better steerage.

Thus the high-level canal is not only deep and wide, but also much freer from troublesome curves than might be supposed from a casual inspection of its course. The details of the bottom width of the high-level canal in its different parts are as follows:—

From the Atlantic entrance to Juan Grande (27 miles)	1000 feet.
Juan Grande to Bas Obispo	500 „
Bas Obispo to a point about half-way between Empire and Culebra	300 „
Culebra cut, nearly to Pedro Miguel lock (about 4 miles)	200 „
Pedro Miguel to Pacific entrance	500 „

The length and width of the locks has already been stated. The maximum lift will be 32 feet, or about 4 feet more than in any other locks at present in use. As the width (110 feet) is much greater than that of existing locks, it follows that the lock gates will be far larger than any now in use. A vessel has to pass through a flight of three succeeding locks at Gatun. Parallel with this is a second flight of three locks, so that two ships could be simultaneously put through either flight in the same, or in opposite, directions.

It is hoped to accomplish the whole transit in eight or ten hours. On this basis it is calculated that forty ships could be put through in twenty-four hours from the Atlantic to the Pacific, or two fleets of twenty ships if passing simultaneously in opposite directions.

At Pedro Miguel the vessel passes through one lock on her way down to the Pacific, and at Milaflores through two locks. Each of these three locks has a duplicate alongside, permitting, as at Gatun, the simultaneous passage of a companion vessel, or of one going in the opposite direction.

The lift of the lower lock at Milaflores is variable, depending upon the level of the tidal water in the last reach of the canal. The extreme range of the tide at La Boca, the Pacific entrance to the canal, is 20 feet, that is to say, low water during "spring" tides is 10 feet below the average sea-level. During low tide on the Pacific side, therefore, the water in the canal stands 95, instead of 85, feet above that sea. The sea on the Atlantic side is practically tideless.

Beyond Milaflores locks the vessel enters a reach of the canal which is exposed to the ebb and flow of the tide, and *which will be confined within banks or levees as far as La Boca.* In this respect the plan and the profile are, unfortunately, misleading. The La Boca lock and dam have been abandoned, and no Sosa lake will therefore come into

existence, the lowest locks being, as I have said, at Milaflores. I have thought it better to reproduce the existing maps as they stand, rather than to attempt a redraught, which would necessarily be imperfect. The vessel, then, below Milaflores is in a tidal channel, and will be subject to some tidal current. By designing this channel so as to avoid a bottle-neck, and by giving it a width of 500 feet, the calculated current will, however, not exceed 1 foot per second.

It will be seen from the plan that the dredged sea-channel by which the vessel will reach deep water on the Pacific, passes to the west of the Isle of Naos, instead of to the east, as was proposed in the earlier plans. Such will be the navigation of the canal. I proceed to deal with the most important points relating to its locks and dams.

The mitre sill of the top lock at Gatun is 37 feet above mean sea-level, and, if the locks were broken, there would remain 32 feet of water above the dam. Above the Pedro Miguel and Milaflores locks there is not the same surplus depth of water.

Dams have to be constructed in the vicinity of the locks at Pedro Miguel and Milaflores. At both places the dams will be short, and will be founded upon hard rock,* and in each case the head of water to be held up will only be about 40 feet instead of 80, as at Gatun. The construction of the dams at Pedro Miguel and Milaflores is not, therefore, regarded with anxiety.

The great Gatun dam remains the one important experiment in the scheme of the high-level canal, and much attention is being devoted to the planning of this work. The alluvial foundation is a disadvantage shared by the Bohio site formerly chosen, and all other sites in the lower Chagres valley; so that, having decided upon the Panama route and a high-level canal, there appears to be no alternative to the construction of a dam upon this kind of bottom. The details of the proposed structure as elaborated in April, 1908, were as follows:—

The length of the great earthen dam is 7700 feet; its breadth no less than 2060 feet. The weight of the dam per linear foot is more than sixty times the horizontal pressure of the water in the lake, so that the pressure could not move the whole mass; and the weight of the dam is spread over such a great width that it is not thought that the ground will sink beneath it. The form of the section is shown beside the map of the canal zone, and an idea of the topography may be obtained from the photograph on p. 157, which I took in April, 1908. The eastern end of the dam abuts on the hill of hard, fine-grained argillaceous sandstone in which the lock-site is being excavated.

The dam, according to present plans, is not to be merely superposed upon the surface as originally proposed in 1905. Embedded in its

* 'Canal Zone Pilot,' pp. 316, 317.

earthy mass there is to be a puddled core, and a trench will be excavated to a level of 40 feet below the sea (−40 feet) for the lower part of this core. Nor is this all that is to be done to check seepage beneath the earthen dam. From the bottom of the trench excavated for the puddled core, sheet-piling, made of 4-inch timbers, is to be driven down for another 40 feet, so that sheet-piling and puddled core together will form an impervious barrier to −80 feet; that is to say, 80 feet below the surface-level of the sea, or about 85 feet below the lowest natural surface of the ground. The puddled core is carried up through the earthen dam to the level of +90; that is to say, 5 feet above the level of the lake, which is to be 85 feet above sea. The crest of the dam will be +135 feet, *i.e.* 50 feet above the level of the lake; this excess of height being to provide top weight for increased stability of the whole structure, and also for the purpose of compacting the underlying material. The under-water slopes of the earthy materials have been reduced from 1 : 3 of the 1905 plan, to 1 : 5. On the other hand, it has been decided that the width of 2625 feet given in 1905 was in excess of utility, and that a reduction of between 500 and 600 feet can be made without loss of strength or efficiency.

About halfway across the valley occurs a low hill, on which a house is shown in the photograph. This hill is on the crest-line of the dam, and is useful as giving support to the sides of the regulating channel which will be excavated in it. The material of the hill, however, is not the hard argillaceous sandstone of the lock-site, but merely alluvial. The regulating works themselves will be built of concrete, a solid mass built up to +69 feet, and on this piers will be constructed 8 feet in thickness, between which will be the sluice-gates. By their means the level of the lake will be prevented from rising unduly in flood time.

The capability of the dam to maintain the waters of the lake at a sufficient level in the dry season depends upon their not finding a ready way, either through the dam itself or below it. The construction of the dam is believed to guarantee its own practical impermeability. Not only is there a puddled core, but the soil, sand, and rocks of which the principal mass will be composed, will be laid down in the manner best calculated to secure compactness. With regard to underground flow, there is, across most of the valley, a bed of indurated clay which is regarded as sufficiently impervious, and wherever the puddled core and piling are embedded in that clay, it may, I think, be assumed with some confidence that the leakage will be unimportant. On referring to the section showing borings (see map), however, it will be seen that there are in the valley two old river-gorges which, to a depth of 200 and 260 feet, are filled only with gravel, sand; sand, shells, and wood; clayey sand; and so forth. These gorges, measured on the section shown, have widths of about 1200 and 500 feet respectively at the depth

to which the sheet-piling goes, and extend about 120 and 180 feet below it. How much water may escape by these gorges it is difficult, indeed, I think, impossible, to say.

On the Supply of Water available for the Needs of the High-level Canal.

The construction of the Suez canal was a work of excavation pure and simple. The construction of any kind of canal across the Isthmus of Panama involves another task, second only in importance to the primary work of excavation, viz. that of controlling the rivers.

In the case of a sea-level canal the problem would have been, how to get rid of their waters, particularly in the rainy season.

In the actual case of an 85-foot-level canal, the regulation of the rivers, particularly of the Chagres, presents two aspects, viz.—

(1) In the wet season, disposing of the surplus waters.

(2) In the dry season, conserving water supplied by the rains so as to meet the waste caused (*a*) by locking, (*b*) by evaporation, (*c*) by percolation or other underground flow.

The arrangements for taming the Chagres and its tributaries have already been described. They are, briefly, the construction of the Gatun dam and its spillway. But for a high-level canal it is equally important that there should be sufficient water in the dry season.

Probably there is no problem of the Panama canal which has received more prolonged and careful study than this,* and from the data obtained the authorities are confident of an adequate supply. Yet whatever depends upon climate is liable to unexpected accidents, and I regard as an important safeguard the fact that at Alhajuela, on the Chagres, 9 or 10 miles above Obispo, there is an excellent site for a dam which would form a reservoir where some of the surplus water of the wet season could be stored, and supplied to the canal as required. The details for such a dam were elaborated in connection with one of the earlier plans of the canal, so that the necessary data would be immediately available in case its construction should become necessary in the future. This is especially important in view of the possibility of leakage from the Gatun lake.

On the Present Condition of the Culebra Cut, and on the Methods employed for Excavation and Disposal of the Spoil.

Reference once more to the plan and profile will show at a glance the length and position of the rocky divide, the whole of which is termed the "Culebra Cut," from the name of the town near the highest point. The proposed form and dimensions of this cut throughout the

* See 'Problems of the Panama Canal,' by Brigadier-General Henry L. Abbot, late Corps of Engineers, U.S.A.

THE CUT AT CULEBRA, LOOKING NORTH-WEST.

THE CUT AT CULEBRA, LOOKING SOUTH-EAST.

5 miles of greatest depth is shown beside the map, this being the cross-section adopted at the commencement of 1906, and the stage reached in April, 1908, is shown by the photographs on p. 163. The line drawn across the above section at a level of 120 feet above bottom (160 feet above sea) shows the general level of the bottom of the workings at Culebra itself at the time when the photographs were taken. A narrow pilot cut, only, was then 20 feet lower. All that part of the section below this line (+160) remained to be excavated. Most of the rock above this line has been removed, but not all, for the final width is not, of course, reached at any level until the central portion has been excavated below that level.

The level of the original rock-line shown in this section was +275, *i.e.* 235 above canal bottom, so that the photographs show excavation of 115 feet of rock. There was, however, soil above the hard basaltic rock, of varying thickness, removed to the slope 1 : 2, as shown on the section. The highest original surface of the soil on the centre line of the canal (between Golden hill and Silver hill at Culebra) was +312 feet, so that the photographs in which Golden hill appears show a total excavation of 152 feet along the centre line. As this line passed along a saddle between the two hills the original surface at the sides was considerably higher, so that the total height from the bottom of the cut to the highest berm, or ledge, on Golden hill is considerably more than 152 feet.

The bottom of the canal will be 272 feet below the original saddle, and its depth below this berm is considerably more.

Thus will the gorge appear when the excavation is finished and before the water is allowed to flow in. When full, the surface of the water will be 227 feet below the original saddle, and the passenger on a vessel will gaze upon the scarped banks of a somewhat greater height than this.

For a tide-level canal not only would the depth be 85 feet greater, but, as the slope could not be made steeper, the width of the whole cutting would be correspondingly increased.

With reference to the slope of the sides it is important to note that it has not been found practicable to adhere always to the proposed section, which has to be made flatter, thus considerably increasing the amount of excavation required. Soil-slides in the wet season are a great hindrance, especially at Cucuracha.

Alighting at Culebra station on the Panama railway and proceeding to the western side of the cut, one obtains the most impressive view of the canal works, and this is the spot usually visited by travellers. I first stood there in January, 1907, and returned in April, 1908. The impressions obtained were very different on these two occasions. In January, 1907, after two-and-half years of American occupation, what struck me most was the enormous mass of material which had been

removed by the French companies, and the comparatively insignificant appearance of the American excavations, which could readily be distinguished from the older work already coated with vegetation. It was then that I began to appreciate the heroic labours of the French engineers, whose achievements under circumstances of great difficulty are being daily more and more appreciated and praised by their successors. Turning to study the progress of the work, I watched with delight the operations of the 100-ton steam shovels which, at a distance, when the human hands are not seen, appear endowed with volition. The cars were loaded with surprising celerity and the dirt-train was hauled off to the distant dump by an old Belgian locomotive, part of the machinery taken over from the New Company. But then the hitch came—there were no cars to take the place of those already filled, and the steam-shovel was idle. Looking round I found that many other steam shovels and their crews were idle from the same cause, the machinery for transportation not having been provided in proper proportion to the machinery of excavation. That the time required for the completion of the rock-cut was limited by the possible rate of transportation of spoil, and not by that of excavation, had long been known, and the report of the Board of Consulting Engineers contains elaborate diagrams of space available for shovels and tracks. It was apparent, therefore, that the organization of the work was not yet perfected.

While, however, the fighting force, so to speak, of the Isthmian army was obviously imperfect in many respects, great results had evidently been achieved by the auxiliary services. The Department of Sanitation had already made the Isthmus healthier than most equatorial countries. Food and quarters were excellent; law and order were well maintained.

On the first day of my second and prolonged visit—April, 1908, fifteen months later—I went at once to the same spot on the Culebra cut, opposite to Golden hill, and again surveyed the scene of operations. The change was enormous. The gorge below me was greatly enlarged, the shape of the hills altered, the face of the landscape changed. As I gazed into the deep trench below, the thought flashed across my mind, If my life be spared a few years longer, I will sail through this on a ship.

The reason of the great change was readily apparent. Organization had now been perfected. In the first place, the whole width of the cut was laid down in railway tracks, tier above tier at the different levels, so that the view was like the approach to the metropolitan terminus of one of the world's great railways. Up and down these tracks there came and went without ceasing the spoil-trains, now composed of larger trucks than formerly, with new and ingenious devices for rapid unloading. The number of steam shovels visible was much larger than in 1906; yet they were kept constantly busy, and all the time the drilling machines were at work, boring holes for charges of dynamite, and gangs of men were completing the preparations for explosions in other holes

already completed. Yet if the eyes were raised for a moment from the busy scene below, they rested on a silent wilderness of tropical forest, stretching unbroken to the horizon. I stayed until, at the approach of sunset, the work of the shovels ceased, and hundreds of men swarmed out of the cut and sought their quarters and the evening meal. But all was not over for the day, for now, when the cut was cleared, the shot-firing began. At intervals there occurred a deafening explosion; the earth trembled as in a considerable but preternaturally short earthquake, and masses of rock rolled down the slopes, disintegrated, and ready for the shovel-man when he should arrive next morning. I paid many visits to the cut between Empire and Pedro Miguel, but oftenest at Culebra itself. The sight never palls, and is one of the wonders of the world.

During the day the spoil-trains follow one another at intervals of about three minutes, and if, from any cause, delay occur, the steam shovels, and indeed the whole process of excavation, is brought to a standstill. Any cause of delay is therefore reported at once by telephone to the Superintendent of Transportation at Empire, and all energies are at once directed to clearing the way. On the Isthmus everything gives way to the "dirt" train, as it is usually called. It is this dirt which stands between the American nation and the realization of their long-cherished scheme, and nowhere is the classical definition of dirt as "matter in the wrong place" so appropriate as on the Isthmus.

Let us now see how much matter has been removed, and how much dirt remains which has yet to be removed. I will give first the totals of what has been got out in both dry and wet way, both in the canal prism itself and for auxiliary works.

TOTAL EXCAVATION IN CONNECTION WITH THE PANAMA CANAL.*

By the French companies about	81,548,000	cubic yards.
By the American Isthmian Canal Commission up to the end of June, 1908 ...	40,923,533	„ „
	122,471,533	

Much of the work of the French companies, however, consisted in dredging out sea-level channels at both ends of the canal, whereas the principal American work has been rock excavation in the Culebra cut—or *the* cut as it might equally well be called. The figures relating to the cut are—

EXCAVATION BETWEEN BAS OBISPO AND PEDRO MIGUEL, *i.e.* "THE CULEBRA CUT," 9½ MILES.†

By the French companies	22,600,000	cubic yards.
By the American commission to end of June, 1908	20,125,185	„ „
Total excavated in the cut	42,725,185	„ „
Remaining to be excavated	37,973,063	„ „

* *Canal Record*, July 8, 1908. † *Ibid.*, August 12, 1908, and July 8.

so that at the end of last June the cut was half cut through, one quarter having been done by the French companies and one quarter by the American Commission.*

This statement by itself, however, would give an inadequate idea of the rate at which the excavation is now proceeding, for of the total taken out of the canal prism in the cut since 1904, more than one-half was the work of the twelve months prior to June last, and the rate of progress is now even greater than in the year June, 1907—May, 1908.

On the Date of Completion of the Canal.—Colonel Goethals, Chief of the Commission, when examined early in 1908 at Washington, declined to bind himself to a date for completion, or to an estimate of cost; nevertheless it is not difficult to calculate the date of completion from the actual rate of progress on the assumption that all goes well. The year 1915 is thus arrived at by the authorities for the calculated, though not promised, completion. This is based primarily upon the rate of excavation possible under the restrictions imposed by the narrow gorge along which the spoil has to be transported. It has been also calculated that the constructive works, the locks and dams, would require about the same time as, but not longer than, the excavations. This proper balance between the time required for the two elements, excavation and building, was one of the arguments employed in favour of the 85-foot-level canal, as securing "the utmost practicable speed of construction" † which could be obtained in a canal "affording convenient passage for vessels of the largest tonnage."

Labour on the Isthmus.

West Indian Labour.

The success of sanitation, and the modern facilities for storage of food, have greatly simplified the task of obtaining an adequate supply of navvies for the pick and spade work. At first the commission relied almost entirely upon the West Indian negro, who formed the majority of the navvies employed under the French companies. The commission, however, were profoundly dissatisfied with the result, and reported that the negroes seemed to be disqualified from doing satisfactory work by lack of actual vitality.‡

Nevertheless, they are still employed in undiminished numbers on the Isthmus. The lack of strength was found to be due largely to improper diet, and most of the West Indians are now provided with proper cooked meals, as is done in the case of American and European employees. In order to ensure their profiting by this provision, however, the charge

* The total excavation for the prism of a sea-level canal was calculated by the Board of Consulting Engineers at 231,026,477 cubic yards.

† See address by President Roosevelt to Board of Consulting Engineers, September 11, 1905, "Report of the Board," p. 12.

‡ "Report," December, 1906.

for meals in the case of West Indians is deducted from wages. The result of supplying a nourishing diet has been a marked increase in working strength as shown by output.

Although the climate and products of the Isthmus are so similar to those of their own islands, comparatively few of these employees settle there, but return to the homes they love so well. It is gratifying to an Englishman to find that those who come from the British islands are proud of their citizenship and pleased to greet him as a fellow-subject.

The ordinary West Indian labourer receives 10 cents gold (about 5*d.*) per hour and free quarters. Deducting the 30 cents *per diem* charged for meals, he receives 50 cents (2*s.* 1*d.*) for an eight-hour day, besides food and lodging.

The total number actually at work on the Isthmus on certain days has been—

June 30, 1907.	
On the canal works	14,606
On the Panama railroad	4,979
Total	19,585

and on June 30, 1908, the number on the canal works alone was 16,078.

The total number on the roll is of course considerably more than 20,000, as there are necessarily absentees every day owing to sickness, accident, or other cause.

European Labour on the Isthmus.

In 1906, the number of European labourers on the Isthmus was insignificant, and the commission, at the time profoundly dissatisfied with the West Indians, issued invitations for proposals to furnish 2500 Chinese labourers with the privilege of increasing the number to 15,000.* Nothing came of this scheme, however, while, on the other hand, the already improved, and still improving, conditions on the Isthmus enabled the commission to obtain a largely increased supply of European labour. While the supply of West Indians was maintained constant, or only slowly increased, the additional force required was therefore obtained from Europe. The following figures show this :—

European Labourers actually at Work on

June 30, 1906.	June 30, 1907.	June 30, 1908.
500	4317	4913

The majority were from Greece, Italy, and Spain, each of these countries sending at first about the same number. The Greeks were considered to be physically inferior to the Italians and Spaniards, and

* Report of I.C. Commission, 1906, p. 14.

their number, in April, 1908, was only about 300. The Italians, physically excellent, and standing the climate well, were found somewhat intractable. A large proportion were migrant labourers who had become prone to collective action when dissatisfied, and their numbers in April, 1908, had been reduced to 500 or 600. The Spaniards, mainly Galicians and Castilians, were found to be equal to the Italians in physique and health, and to give far less trouble. The number employed in April, 1908, was about 5000, so that the Spaniards constituted about five-sixths of the European force, which numbered in all slightly over 6000. The figures given above for those at work on certain days are considerably less, there being always a number absent from one cause or another.

The Spaniards do not appear to be oppressed by working in the tropical heat—even at midday at about the hottest time of year. The ordinary European labourer, in addition to free quarters, receives 20 cents gold per hour, or $1.60 per eight-hour day; more when working overtime. He is charged 40 cents per diem for his three meals, served in the European mess, which leaves $1.20 as a *minimum* net wage per diem, or a little less than 30*s.* per week, but many earn more.

The Spaniard shows no sign of settling upon the Zone. Sometimes he goes on to railway work in Brazil, more often he returns home with his savings.

Skilled Labour on the Isthmus.

The skilled labour on the Isthmus has, from the outset, been mainly done by white Americans, but there are still, on the "Gold Roll," as it is termed, some Europeans. New rules reducing the maximum length of leave have, however, made these posts less attractive to those whose homes are at a greater distance, and by an order of February 8, 1908, all future appointments on the Gold Roll shall be American citizens, if the special services required can be obtained in the United States; and in the event of any reduction of force preference shall be given to American citizens.

An eight-hour day is established by law for employees on the Gold Roll, the quarters are excellent, and excellent meals are provided at a fixed charge in the commission's hotels.

I should like in this place to add a word of tribute to the great courtesy and kindness which the American mechanics show towards ladies, a circumstance which did much to render pleasant the excursions which my wife took on the Isthmus, sometimes in my company and sometimes alone.

In this connection, also, I must add a word upon the marvellous respectability of the Canal Zone, where nothing unseemly meets the eye. Taking all the circumstances into account, this is a state of things of which the American nation has reason to be proud.

The number of Americans on the Gold Roll in January, 1908, was about 6000, the total number of employees on the rolls of the commission and of the Panama railroad being then, approximately, 43,000. The total number of employees actually at work on January 29, 1908, was—

On the canal works, January 29, 1908	25,367
On the Panama railroad	6,557
Total	31,924

The Canal Zone now being healthy, the life of the Americans is a cheerful as well as a busy one. Not only do the men look well, but the women and children also.

The children are able to be in the open air all day, for sunstroke is rare on the Isthmus; they are bronzed and active, and apparently thoroughly satisfied with themselves and with their surroundings. Even when within doors they are still in a sense in the open air, for the windows are unglazed, and the houses are constructed so as to secure a free circulation of air.

The commission clubs for gold-employees at the principal stations are commodious structures, admirably designed for social recreation. Their management is entrusted to the Young Men's Christian Association. There are well-equipped reading and writing rooms and gymnasia, mainly used by the men; but the interests of the women and children are not neglected, and for the latter playrooms are provided. The large halls are used for entertainments and meetings. These clubs and other organizations for recreative pastimes have undoubtedly contributed to improve the general health of the community.

On the Future of the White Race in Tropical Countries.

The question whether the white race can make a home in the tropics depends largely upon the tropical baby; upon his own health, and that of his mother. The American occupation is still recent, but, as far as experience goes, it seems that the white children born on the Isthmus have not shown unusual delicacy, and the mothers have made a normal, though sometimes rather slow, recovery from confinement.

With regard to the possibilities of the tropics for the white race, I submit the following tentative conclusions, viz.—

That the debilitating effect which they have been observed to exercise upon those who come from temperate regions has been due mainly to the presence of certain diseases which can be done away with.

That the rapid deterioration of the white stock which is usually noticed in the tropics, especially near the equator, is largely due to the same cause.

But that Anglo-Saxons cannot perform nearly the same amount of hard bodily labour in a constantly hot climate as they can in the temperate zone, and Anglo-Saxon immigrants never will be able to do

so. In this, I think, the Mediterranean races, at all events the Spaniards and Italians, are our superiors.

Whether the descendants of Anglo-Saxon stock who have settled in a tropical country purified from tropical diseases will be able to support continued hard bodily labour better than their immigrant ancestors is a matter about which we have at present little direct evidence.

It is the case that in the tropics, particularly in the equable equatorial belt, many evils of the temperate zone are avoided, chiefly those due to cold and to sudden changes of temperature. It is this equatorial belt of equable temperature and heavy rainfall that I chiefly have in mind, for it comprises those vast regions of prolific vegetation which appear capable of supporting so large a population.

The white man already rules, or has marked off for rule, the whole of the equatorial belt, but who is to be the peasant cultivating this belt? In those parts of tropical Asia already peopled by industrious Orientals there can never be a white peasantry. Equatorial Africa presents great differences in different parts with respect to native population, and the question of a possible future for white peasantry is there a complicated one. In South America, however, there are vast equatorial regions either wholly unpeopled, or sparsely inhabited by tribes of that Indian stock which has elsewhere proved so slight an impediment to the establishment of the white labourer. Served by a system of rivers unrivalled elsewhere in equatorial regions, already partitioned among Christian governments, and for the most part uninhabited, equatorial South America offers the readiest field for the establishment on a vast scale of a white peasantry under the equator.

By clearing the scrub within 100 or 200 yards of his cottage, and by employing wire screens, the cultivator can protect himself against the malarial mosquito, and his crops come not once, but several times, a year.

If the Spanish, Portuguese, and Italian peasant were to turn his attention to this field, instead of, or in addition to, that of navvy work, great things might come of it. The circumstance that South America is a Roman Catholic continent, where the Latin races are dominant, would greatly favour the experiment. On the Zone the Spanish labourer works in order to save and to depart; the *milieu* being foreign to him and unattractive. In a Latin state it would be different.

I put these opinions forward with great diffidence, knowing that they differ somewhat from those of Colonel Gorgas, who thinks * that the future of the white race lies principally in the tropics. The general opinion among Americans on the Isthmus seems to be that, as far as they are concerned, they would, if engaged in the tropical parts of South or Central America, avail themselves of the improving means of

* "Sanitation in the Canal Zone," by Colonel W. C. Gorgas, M.D. *Journ. Am. Med. Assoc.*, July 6, 1907, vol. 49.

transit to revisit frequently the United States, and would rely upon such vacations in higher latitudes for the retention of their native vigour.

On the Shortening of Distances.

The sole object of a ship canal is to shorten sea distance. The following figures are actual steaming distances as calculated by the United States Hydrographic Bureau. From New York to Panama, or any port on the Pacific coast of America north thereof, a reduction of 8400 miles. From New York to ports on the American-Pacific coast south of Panama a reduction varying from 8400 to about 1000 miles, on an average about 5000 miles. The corresponding reduction from Liverpool to these coasts is 6000 and about 2600 respectively. The figures for Antwerp are about the same. From New York to Yokohama, *viâ* San Francisco, the reduction is 3729 miles, bringing the Japanese port 1805 miles nearer to New York than to Liverpool. From New York to Shanghai the reduction is 1629 miles, which leaves Liverpool 295 miles nearer to Shanghai.

The Panama canal will not shorten the distance between New York and Hong Kong, Suez being still the shorter route, and even to Manila the reduction *viâ* Panama is only 16 miles; moreover, this small reduction is by way of San Francisco and Yokohama. The all-American route from New York to Manila *viâ* Panama, Honolulu, and Guam is 128 miles longer than that *viâ* Suez. As we go further south in the Pacific, however, the Panama route again is the shorter from New York. Thus the distance to Sydney is shortened by 3806 miles (*viâ* Tahiti), the distance being 2382 less than that between Liverpool and Sydney *viâ* Colombo, Adelaide, and Melbourne. The reduction between New York and Wellington, N.Z., will be 2542 miles, bringing Wellington 2759 miles nearer to New York than to Liverpool.*

The distance between Liverpool and Wellington *viâ* the canal is slightly less than that by the Straits of Magellan. There is also a reduction of distance between Liverpool and the northern parts of the Siberian coast. Otherwise the Panama canal does not shorten distances between European ports and those on the "Oriental" side of the Pacific, the route having been short-circuited by the construction of the Suez canal.

New Orleans and other ports on the Mexican gulf obtain even greater reduction of sea distance to Pacific ports than that obtained by New York; and the important island of Jamaica, with its spacious harbour of Kingston, will be placed in a position of centrality for world commerce which it does not at present enjoy. May the opening of the canal help to restore the fortunes of those who have been afflicted by hurricane and earthquake! That the canal will greatly increase

* *I.e.* Liverpool to Colon, 4720; New York to Colon, 1961; difference 2759 miles, the subsequent routes being the same.

the importance of Jamaica as a member of the British Empire there can be no doubt.

We have seen that the greatest reductions of distance resulting from the canal are those between the two coasts of North America. The sea route, however, remains much longer than that by railway, so that the commercial benefit is (relatively to reduction of distance) less than in the opening up of the Pacific coasts of South America, New Zealand, Japan, and the northern parts of Asia. The approximation of the two coasts will, however, have a profound effect upon the naval position of the United States.

Finally, we must note the peculiar position of that part of the world lying between 40° N. and 40° S., and the meridians of 120° E. and 160° E. of Greenwich. This band, which includes Japan, Korea, Shanghai, the Philippines, New Guinea, and most of Australia, is peculiarly situated with respect to canal routes to the manufacturing countries of the Occident.

Near its western margin the Suez and Panama routes to New York are of equal length. Near its eastern margin, which lies, however, mostly at sea, the Suez and Panama routes to Liverpool are of equal length.

On a line rather west of the centre all places are equidistant from New York and Liverpool, the former *viâ* Panama, the latter *viâ* Suez.

On the Steamships available for Canal Transit.

The Isthmian Canal Commission in the report of 1899 distinguishes between the commercial and the industrial benefits of the canal, meaning by the former term the increased carrying of goods, and by the latter the development of production induced by improved facilities of carriage.

The tables of distances already given show the *potential* commercial advantages, and how they are distributed in different measure among different countries, and these figures have all the permanence which makes geographical figures of such importance. But the actual commercial advantage of a ship canal depends equally upon a second factor, viz. the available ship tonnage. Supposing a Panama canal to be open at the present time, there would be hardly any United States ships to use it, except in transport between home ports from which ships flying foreign flags are debarred. The transport to South America, New Zealand, Australia, Northern China, and Japan would necessarily be almost wholly carried on by ships of other nations, especially British and German.

In the spring of 1908 there was not one steamship flying the flag of the United States between her ports and those of Brazil, the Argentine, Chile, or Peru.*

* *Congressional Record*, February 24, 1908.

The three steamships of the Oceanic Line, formerly plying to Australia, were then laid up in the harbour of San Francisco, being unable, although subsidized for mails by the United States Government, to compete with foreign vessels. There were, however, three United States steamers plying from Puget sound to Japan and China, occasionally reaching the Philippines.

The mails from New York and the other Atlantic ports of the United States to Brazil and the Argentine go *viâ* Europe, so that in this important matter New York is actually 3000 miles further than Europe, instead of being 370 miles nearer, to those countries.*

Ships receiving the United States mail subsidy, the only form of subsidy given, have to be American built, manned by Americans, and the diet of the sailors is prescribed by law. Senator Depew † says that, "The labor unions have rightly and properly taken care of their wages. The result is that the cost in wages and food to run American ships under American conditions across the Pacific is double that of European or Japanese steamers."

The relative cost of operating American and European vessels was given by the Hon. Elihu Root, Secretary of State, in an address delivered November 30, 1906,‡ as follows:—

The operation of an American steamship of 2500 tons costs $18,289 per annum more than that of a British ship of this tonnage, or $7·31 more per ton; and

The operation of an American steamship of 3500 tons costs $15,315 per annum more than that of a German ship of the same size, or $4·37 more per ton.

Thus it is evident that in spite of geographical advantages, there is at present some ground for the extreme opinion sometimes expressed in the United States, that the canal is being built with American money for the use of Europe—and, one may add, of Japan.

What attempts may be made to remedy this state of things, and what effects such attempts may have, are speculative matters which do not come within the scope of this paper.

The Cost of the Canal.

Of the existing canals for ocean-going ships that of Suez was built by a company as a commercial undertaking, to earn dividends from tolls. It cost $90,000,000. The Manchester ship canal is partly commercial, partly industrial, *i.e.* the large contribution of the city of Manchester was made, not as a financial speculation, but in order

* Senator Gallinger, *loc. cit.*

† *Loc. cit.*

‡ Address to Mississippi Commercial Congress, Kansas City, revised by Mr. Root, and published *Nat. Geogr. Mag.*, 1907, vol. 18, pp. 61–72.

to promote an undertaking likely to develop the industries of the city. This canal, partly commercial, partly industrial, cost $75,000,000. The Kiel canal has further a military purpose, providing a short line of communication for warships. It cost $40,000,000. The Panama canal is commercial, industrial, and military, and will cost more than all the above put together.

Up to June 30, 1908, the United States Government have spent $126,047,062 on the Panama canal,* made up as follows :—

Payment to New Panama Canal Company, $40,000,000, and to Republic of Panama, $10,000,000	$50,000,000
Expenditure on work prior to July 1, 1907	43,172,408
Expenditure on work, July 1, 1907—June 30, 1908 ...	32,874,654
	$126,047,062

The amount authorized to be appropriated by the Act of June 28, 1902, was $135,000,000 plus $50,000,000 purchase money = $185,000,000 in all, for the "canal, harbours, and defences." What the total cost will be is unknown, but Colonel Goethals stated in evidence (January, 1908) that the canal would cost at least $250,000,000, and possibly as much as $500,000,000. The combined cost of the Suez, Manchester, and Kiel canals has been $205,000,000.

The following important ship canals have been completed for smaller sums :—

U.S., S.St. Marie (somewhat more than)	$6,000,000
Canadian do. (nearly)	4,000,000
Amsterdam	10,000,000
Corinth (about)	5,000,000
Cronstadt (about)	10,000,000
Welland (Lake Erie–Lake Ontario)	24,000,000
	$59,000,000

Adding these figures to those already given, we have a grand total of $264,000,000 for the cost of nine of the greatest existing ship canals, which is about the same as the lowest current official estimate for the final cost of the Panama canal.

In my study of the Panama canal, of which the present paper is necessarily but a summary account, I have been assisted by many persons, and desire to thank particularly the Department of State at Washington, the Rt. Hon. James Bryce, the Rt. Hon. Lord Avebury, Mr. Claude Mallet, C.M.G., and Colonel G. E. Church. Also Colonel Goethals, chairman of the Isthmian Canal Commission, and his colleagues and assistants, who received me most kindly. Among them I must particularly thank Colonel Gorgas, Major Gaillard, Major Sibert, Major Harding, Mr. Jackson Smith, Mr. Bucklin Bishop, Mr. Arango, Mr. G. R. Shanton, Mr. William Gerig, and Mr. Mason W. Mitchell. I also

* *Canal Record*, August 12, 1908.

profited by the learning of Mr. Tracy Robinson, an historian of Isthmian affairs.

I left the society of the men who are making the canal with great regret. I cherish the hope that I may revisit them, that I may see their task crowned with success, and that I may yet gaze from the deck of an ocean liner upon the terraced sides of Culebra cut.

Before the paper, the PRESIDENT: No words are needed on my part to introduce to you Dr. Vaughan Cornish, who has given us so many papers before, and whose lectures we have so often enjoyed. He has generally for his study taken the study of waves, but to-night he deals with a different class of problems. He is going to discuss the Panama canal, and discuss it from every possible point of view which can in any way be considered geographical. As you have come to listen to the lecture and not to me, I will, without more ado, ask Dr. Cornish to kindly deliver his lecture.

After the paper, Colonel G. E. CHURCH: We have listened with keen interest to the lecturer. He thoroughly understands that any one describing the work being carried out at Panama should be extremely careful of his statements. I do not share in the idea that the white man can compete with other races in occupying tropical lands. There are, of course, in America immense areas of these, notably in the Amazon valley, mostly malaria infested; but I do not believe that the mosquito is entirely to blame for the malaria. I have in mind at this moment a work which is being carried out in the Amazon valley, an old enterprise of mine, the Madeira and Mamoré railway, situated exactly in the same latitude south of the equator as Panama is to the north. There are now 1500 men employed on that work, and measures of sanitation have not been taken similar to those of Panama, although every provision has been made for the health of the men. I have recently had information from there that the negro, while he does not fall ill with malaria so quickly as the white man, recuperates from it with less rapidity. It is a curious fact that there are no mosquitoes but plenty of malaria along the line of the falls of the Madeira. I have no doubt that the white man could occupy the whole Amazon valley if he had the United States Treasury behind him to give sanitation like that of Panama. Unfortunately, the emigrant to new countries is generally very poor, and is unable to carry with him many tons of petroleum, and organize brigades of men to fight mosquitoes. These lands cannot be occupied by white men in competition with negroes and other races of tropical breed. I have been struck with the marvellous feats of administrative ability performed at Panama by the French and Americans, and yield humble tribute to the engineering talent of France and to that of the corps of engineers of the United States army, that they should have planned and carried out so admirably such magnificent works as are now proceeding there. But I also submit that they have not yet tackled the great problems incident to the cutting of the canal; these are still to come, and we must withhold our judgment until we see them well under way. It is now twenty-seven years since work was commenced by the French, and it is *an astounding fact that the definitive plans for the canal have not yet been decided upon.* Meanwhile, millions sterling have been poured into that Danaïdes sieve simply to "*make the dirt fly.*"

But what is the Panama canal being cut for? Is it for commercial purposes? or strategical reasons? or for a better control of the Pacific ocean? Look for a moment at its commercial position. Ninety-four per cent. of the population of the

world lies to the north of Panama, and of the other 6 per cent., the traffic that it will give the canal is not very great. If the United States Government is so anxious for commercial development, why has it so neglected the eastern side of South America? There are to-day 3000 European steamships yearly entering and clearing at the ports of Buenos Aires and Rio de Janeiro, and not one of them carries the American flag. The Argentine Republic alone is doing to-day, with its 6,000,000 of population, a larger export and import trade than the entire 400,000,000 of the Empire of China.

It may sound rather strange to you, but South America does more export and import trade than the Indian Empire of Great Britain. But where does that trade come from? It comes almost entirely from the eastern side of the Andes, within as easy reach of New York as it is to the ports of Europe; and yet, as I say, you look in vain for the American flag there. But they tell us, and I have seen many articles written in American magazines and newspapers about it, that wonderful results are to take place on the Pacific coast when the canal is opened, and that this west coast trade will go largely to compensate for cutting it. Only 6 per cent. of the area of South America lies on the Pacific slope of the Andes, and the twenty-eight passes of the Andes lying between 7° 45′ and 23° S. lat. average above 15,000 feet elevation, the lowest being 10,000 feet. Surely it is not proposed to cross those passes with railways, to take the trade of eastern South America across the Cordillera.

Is the purpose of the canal to give us more brotherly relationship with the eight millions of Philippine *Objects* we purchased of Spain? (I call them *Objects* for the simple reason that we have no *Subjects* in the United States.) But Manilla, the capital of the Philippines, is exactly as near New York by way of Suez as it is by way of Panama. Is it worth cutting a Panama canal to save the 16 miles difference that Dr. Vaughan Cornish told us of? There is another point, any voyage between the ports of Europe and Asia is shorter for ships by way of the Suez canal than it is *viâ* Panama; therefore you may eliminate at once the entire inter-trade of Asia, Africa, and Europe from the influence of the canal. Again, suppose the canal were opened to-day, and with a toll, say, of 4*s.* per ton, which I suppose would be the minimum, can it compete with the Pacific railways across the continent? Is it possible that a man sending goods to the eastern part of the United States will ship them say, from 100 miles inland in California to the Pacific coast, put them on to a steamer, carry them through the canal round to New York or Philadelphia, and then transport them by rail to the interior, or will he at once put them on to a Pacific railway? What would be the cost of freight *viâ* Panama, including canal toll, between New York and say San Francisco or Vancouver? Surely not less than 30*s.* a ton, if we measure by freights as they are now or have been for the last two or three years; and yet, Mr. President, the Canadian-Pacific railway to-day has a regular freight tariff of 30*s.* a ton between Montreal and Vancouver. Do you suppose when the canal is completed that the railway rates cannot be lowered? I assure you the Pacific railways look as if they might very readily beat the canal on the freight question, for not only will they carry goods more expeditiously, but for less cost of insurance. Able men have played with statistics in a very curious way; they figure that the canal will commence with a traffic of anywhere from five to seven millions of tons. How do they get these figures? By taking all the entrances and clearances of ships at ports possibly tributary to the canal. But this is a very crude method. The Pacific coast of South America or North America is an example, because there it is that the canal hopes for its largest traffic. Take the little Costa Rica port of Punta Arenas on the Pacific, which shows about 320,000 tons a year of commerce on the

basis indicated; the actual fact is that it does about 12,000 tons of trade a year. Take the west coast of South America, there are regular lines of English and Chilean steamships that go up and down the coast, touching every day at two or three ports, dropping and picking up a few tons of cargo, and every port touched is given credit for entrances and clearances of from 5000 to 10,000 tons, according to the registered tonnage of the steamer. Thus the French Panama Company, as well as the United States Commissioners, have always made their figures. I may say that, with a year of labour, I analyzed all the commerce that would possibly go through the canal if it were open to-day, and I could not make it a million tons; so I will leave the commercial aspect of the canal for those mathematicians who see millions of tons in one steamship every year.

Finally, has the Panama canal a strategical aspect? Yes, it is strategical. In all time, I believe, nations have fought tremendous wars to turn the trade of the world across their territory. My country is the only one that seeks to "side-track" the grand trade avenues created by the private capital and resourceful energies of its own people. There is a mountain wall known as the Rocky mountains and the Andes, extending from the Arctic sea to the Straits of Magellan which seems to bar off Europe from any contact with the Pacific by a western, route except by the way of Cape Horn. It gives the United States a magnificent controlling position; and I do not see why we want to abandon it by opening a gateway through the centre of it. I come to the naval aspect of the canal, but with much diffidence, for I see some very able naval experts here to-night. I believe that it will take just as many ships to defend the Panama canal in case of war as it would to defend the Pacific coast without the canal, and that the interest on the cost of the canal (say, on at least £100,000,000 sterling) would keep many battleships in commission.

Mr. Bernacchi: About eighteen months before Dr. Cornish's second visit I found myself compelled to spend seven days on the Isthmus of Panama—seven of the most dismal and uncomfortable days I ever spent, and when I say uncomfortable, I do not at all express what I felt. But notwithstanding the climate, hotels, and other things in general, the Isthmus is of deep interest to the scientific traveller. What impressed me was the fact that although so much time and thought had been devoted to the organization of the various departments, the educational question had not been forgotten. The year of my visit witnessed the establishment of English free schools in the various municipalities.

Three of the chief obstacles at that time appeared to me to be, first, the nature of the country itself; second, the flood waters of the Chagres river and the construction of those immense artificial dams; third, the scarcity of labour. The last difficulty has, we are told, been overcome, but I still believe that the Panama canal, should it ever be completed, will be built in the main by Jamaica labour, by the Jamaica negro.

Mr. Mackinder: I listened with very great interest to the criticisms of Colonel Church, and with a great deal of what he said I agree. But I submit that whether you regard the matter from a geographical or a financial point of view, he wrote off the strategical side of the question rather too lightly. Even if you take the cost of the canal as one hundred millions, that would only build forty capital ships nowadays, and Great Britain has already more than forty such ships in commission. If the United States mean to have one of the first-rate fleets, the cost of that fleet would be more than equivalent to that of the Panama canal, and such a fleet has to be rebuilt every fifteen years. Therefore I submit that since two oceans are concerned, the cost of the canal might prove to be a very valuable investment. The part of the United States which lies west of the hundredth meridian west has a

very small rainfall except along the border adjacent to Canada, and in California. The vast majority therefore of the American population must, probably for all time, live on the Atlantic slope. But the United States is deeply interested in Oriental markets, and she carries a great deal of traffic across the continent, therefore she is interested both in the Pacific and in the Pacific terminals of her railways. Her chief base of power must, however, be on the Atlantic coast. Her motives are thus those which induced Germany to make the Kiel canal. I submit that the construction of the Panama canal is not a bad investment for the United States, given the intention of being a naval power on both oceans.

Mr. THEODORE WALKER, who had been to Panama last spring, remarked that the tide on the Pacific side is, as far as he could judge, 14 to 20 feet higher than on the Atlantic side, where it was, he believed, only about a few inches. In that case, he thought it would have been very difficult to have made a canal on the level from sea to sea.

The PRESIDENT: Time is getting on, and I think I had better bring this discussion to a close by giving a very hearty vote of thanks to the lecturer, Dr. Vaughan Cornish. We have had an extremely interesting discussion, and I should like before he replies to ask one question, with regard to the effect of opening the canal. I cannot help believing it would have been possible to make some sort of rough estimate of the saving to the world at large in the shortening of distances, and therefore, from this point of view, of the capital value of the canal. I should like to know from Dr. Cornish what in his opinion is the best estimate, from the purely commercial point of view, of what the canal will save to the world. No doubt the French would have been wise if they had made such an estimate before commencing this work. The Americans, also, might have been wise to do so, but I do not think it would have stopped them either. They have what I may call a sentimental reason for their actions—a feeling that this great work has been commenced and ought to be finished at all hazards. I also think that the strategical value of the work to the United States will be very great indeed. The canal is to be opened to ships of war in time of war, and if one considers the advantages of being able to transfer ships from the Pacific to the Atlantic when such a power is denied to their opponents, any one must see that the canal will be worth a great deal to the United States.

Dr. CORNISH: The advantages which it is hoped to obtain for the United States by the construction of the canal are of three kinds, viz., commercial, industrial, and military; and the event which determined the building of the canal was a military one. This was the voyage of the battleship *Oregon* in 1898, at the commencement of the war with Spain. This vessel, one of the few battleships which the United States then possessed, was in the Pacific, and had to steam round South America to effect a junction with the remainder of the fleet. For weeks the whole nation was kept in a state of nervous tension until the news of her arrival at Key West. This experience created a general feeling throughout the country that an Isthmian canal was necessary—a feeling which provided the Administration with the necessary motive power. Whether this instinctive strategy be right or wrong is a matter upon which experts differ. The shorter line of communication increases the power of offence, but entails responsibilities of defence. Whether the advantage or the disadvantage is likely to be the greater is a question, the answer to which depends largely upon another question, viz. Which nation or nations are likely antagonists? That is a question which it would be difficult to discuss non-politically, as our rules require. On account of the mixed motives for the construction of the canal, I have not examined very carefully the direct financial return, for I do not think the undertaking can be properly regarded as a business concern.

SURVEY WORK ON THE FRONTIER BETWEEN BOLIVIA AND BRAZIL.

By Major P. H. FAWCETT, R.A., Chief Bolivian Commissioner.

THE following short sketch of the work completed and in course of operation on the Bolivian and Brazilian frontiers may be of interest, as explanatory of the plans already submitted to the Royal Geographical Society.

It is possibly superfluous to say that a resurvey of the frontier between the two republics became necessary when, in 1903, following on the revolution in the Acre, Bolivia parted with the seventy odd thousand square kilometres of land lying between the Acre and the source of the Javary for a sum of 2,000,000 sterling, and certain modifications of the frontier on the Paraguay river. It was in consequence of this that, early in 1906, I was invited to undertake the exploration of the northern portion of the new frontier, from the falls of the Madeira to the source of the Acre, the geographical conditions of which were but vaguely understood. Mainly, the new frontier rested upon the relation of the upper Acre to parallel 11° S., and the geographical co-ordinates of the sources of the Iquiry and Rapirran. The actual exploration consisted in the ascent of the Alto Acre, the search for the sources of the above-mentioned rivers, and the descent of the Abuna. Three years were anticipated for the work. It actually exhausted nine continuous months of journey, starting from and returning to Riberalta, on the Beni. As in all these out-of-the-way corners of the interior, the chief difficulties lay in food supplies, and in the acquisition of *personnel* to accompany the surveying party. There were various other difficulties. On the whole, however, these were satisfactorily surmounted, and if one may except the dragging of heavy canoes for six weeks over the rapids of the Alto Acre, and the somewhat trying rains which left the party rarely dry day or night, it was even enjoyable. The river follows the course already determined by Chandless in 1868.

Hostile savages range the forests to the west of the confluence of the Yaverija, near which rubber exploitation ends. But although they constantly attack the rubber-pickers, they did not molest the party in any way. We were but seven all told in the higher river. Following on the determination of the sources of the Iquiry and Rapirran, in the comparatively high land lying between the Acre and the Abuna, my assistant, Mr. A. F. Chivers, returned to Riberalta and thence home, being unwilling to court the very unhealthy conditions of the latter river after an experience of fever during the previous months. I was, fortunately, able to secure, at a huge price, a very small boat in the upper Abuna, and ultimately descended that river to its confluence with the Madeira, in company with a young Bolivian and three Indians, two of whom subsequently died. The whole region, inundated every year, is villainously

unhealthy; nor is the journey otherwise very attractive, for during half its course it is infested with Brazilian criminals who are notoriously loose in their respect for human life, while in the lower half of the river the Pacaguara savages are a constant danger. Moreover, the sucuri or anaconda is unpleasantly prolific. These snakes reach almost fabulous dimensions, according to local accounts. We killed one of 20 metres, and I have the authority of Admiral Guillobel, of the Brazilian commission, for one of 26 metres, killed near Corumba, in the Paraguay. In the Abuna they are credited with man-eating proclivities, and it is certain that their well-worn trails from the swamps suggest dimensions altogether beyond the bounds of European credulity. The tiger of South America, the jaguar, is, too, very common. These beasts are frequently man-eaters in these parts. They invaded the camp pretty well every night, and once I was awakened by one scraping his back as he passed under my hammock.

Beri beri, the scourge of the Acre, and the whole gamut of tropical fevers are rife, and altogether I am not anxious to revisit this region. Its descent was therefore in the nature of running a gauntlet. The Acre is navigable from December to April up to the confluence of the Yaverija, and the Abuna during the same months. In the dry season they are both merely shallow streams, and much obstructed by snags. At the end of October, 1907, after two and a half months' journey from Riberalta, during which I was wrecked three times in the Beni, I returned to La Paz.

The results of the exploration can be summed up in the willingness of Brazil to accept the Alto Acre as the frontier line from Bahia west, a direct line from Bahia to the source of the Rapirran, and thence the courses of that river and the Abuna to the east. The Iquiry disappears from the treaty, its position having been misunderstood. A joint commission will put up the frontier marks probably in 1911.

On my return to La Paz I was invited by the Government to undertake the technical management of the commission to work jointly with the Brazilians in the Paraguay river, and as this offered considerably more interest than the monotony of the Amazonas, I found myself at the beginning of May, 1908, in Corumba, with Mr. F. G. Fisher and a capable French engineer, Mr. Vandry, as assistants. Here, again, the estimate of time for the completion of the frontier work was altogether in excess of requirements. Within three months, not altogether I am afraid to the liking of our Brazilian colleagues, we had completed the whole of the more important work in the neighbourhood of Corumba, and were brought to a stop by an abnormal unwillingness on the part of the Paraguay waters to fall below inundation level. I therefore decided to leave my French colleague to complete some short geodetic measurements in the lakes of Mandioré, Gaiba, and Uberaba, and represent the technical portion of the commission at the formal erection of the permanent marks

in the positions fixed, and to take Mr. Fisher and half a dozen peons to discover the true source and course of the mysterious Verde, a river which had baffled the efforts of five Government commissions, and which is a portion of the frontier it was of vital interest to Bolivia to have definite knowledge about.

The Brazilian Commission declined to supply a representative, and politely considered us mad. There were, in truth, somewhat potent reasons for mature consideration. Civilization, such as it is to the north of the flourishing town of Corumba, ends completely at the old ruined city of Matto Grosso, where culminate in a horrible disease, locally known as "corupcion," that long list of infirmities which makes the interior in general, and the negro-inhabited Matto Grosso city in particular, probably the unhealthiest regions in the world. Moreover, anthropophagous savages abound, even within gunshot of the old city. However, these things were never a deterrent to those bitten with the lust of exploration. Suffice it that, after a lengthy journey by river and mule and various vicissitudes, the party entered the Verde from its confluence with the Guaporé. The entire river runs through sandstone hills, with deep gorges and endless cataracts. So difficult was the river to ascend that the peons were unable to carry more than their rifles and ammunition, their hammocks, and a theodolite. I had to decide early between an abandonment of all food or an ignominious return. Depending upon at least fish, we were rudely disillusioned, for the water of the river, owing to a species of coarse green grass which covers the bed and lends the river its name, is so unpleasantly affected to the taste that neither fish live in its waters nor game in the surrounding forest. Rain, which fell every day for six weeks, accompanied by violent thunderstorms, became in a sense welcome, for it gave us occasional chances of satisfying a thirst born of struggling thirteen hours a day through desperately thick and thorny undergrowth.

For about two months the party traversed this region without food of any recognized description, even salt, living on the heart of the palmeto palm and on chunta nuts, and by the intervention of Providence alone struggled back to Matto Grosso a mere collection of bones. Three out of six peons subsequently died, and all the dogs, four, failed to survive the journey. The course of the river was, however, determined, and the source referred by triangulation to Matto Grosso city. When we ultimately returned to the lower forest near Matto Grosso, and partially appeased appetite for flesh by a fortuitous encounter with three or four black monkeys, the peons devoured their skins with the fur attached. In Matto Grosso even the half-rotten *chaki* appeared delicious. The extraordinary difficulties of the journey, apart from food, are more due to the nature of the hills, which are intersected in all directions by deep gorges in the sandstone dropping sheer 100 metres to the numerous small streams which drain the high levels. The plans which accompany

this indicate generally the physical features of this region. Geologically, the hills are sandstone with outcrops of schist and quartzite and a little granite, rising suddenly from the alluvial plain of the Guaporé to a height of 300 to 700 metres. The savages again left us alone. We were too small a party to menace them in any way possibly. They were around us throughout, and often the night was lit up by their fires. Their presence necessitated, however, a double sentry every night, for their ways are treacherous, and the tale of their misdeeds long and fearsome. Late in November the remains of the party returned to Corumba, where they were warmly welcomed.

During the present year the commission ends its labours in the fixing of permanent frontier marks at the newly discovered source of the Verde, and the settlement of an outstanding question over Cuatro Hermanos, the most western point, some 100 kilometres to the south. This short sketch may serve as some indication of the work of the commissions pending more complete reports later on.

South America, which is unmistakably the country of the future, is remarkably little known in the interior, and there are many blank spaces still to be filled. It is full of amazing romances which might repay investigation, of unknown rivers, lakes, and mountains, of unknown races, of riches still untouched, almost beyond imagination. The explorer practically leaves it alone, perhaps because the blank spaces are so difficult to reach. In the low country it is exceedingly unhealthy. Almost without exception the savages are hostile; they are very numerous, and they use poisoned arrows. Time has changed sadly from the days when Chandless could safely explore the Amazonas, and be sure of a friendly welcome from its savage inhabitants. For years, civilized and savage have shot one another at sight. The perils of the rivers are perhaps as in no other country. The "perania," the "candaru," the "mungruyu" or fresh-water shark, the anacondas and alligators associate any accident with unpleasant possibilities. The forests in places are obsessed with poisonous snakes, and occasionally even the ordinarily timid jaguar is savage. Civilized man in the interior knows no laws.

Outside the trade-routes there are no roads for animals, and it is difficult and often impossible to secure even a few peons for the carrying of stores. Labour is everywhere scarce, and peons are unwilling to risk their lives in unknown parts. Later these things will change. Railways are creeping up from the south, and their tentacles are clutching at the wild interiors of Brazil and Bolivia, while the Madeira railway and the North-West railway from San Pablo to Corumba are under construction. The republics of South America are all awakening from their indolence to encourage immigration. Movement and trade in the navigable rivers are increasing. Resources, vegetable and mineral, are immeasurable. The climate of the uplands is splendid. The wretched policy which created a slave trade, and openly encouraged a reckless

slaughter of the indigenous Indians, many of them races of great intelligence, and imbued them with a deadly vengeance against the stranger, is giving place to wiser and more humane treatment. But advance is already making more acute the question of frontiers, and South American Frontier Commissions are likely to be much heard of in the future. They should provide interesting additions to the Geographical and Ethnological history of the world, and incidentally bring Europe more into touch with the cultured and enlightened peoples of this great continent.

THE ITALIAN EARTHQUAKE OF DECEMBER 28, 1908.

By R. D. OLDHAM.

THE earthquake of December 28, 1908, stands pre-eminent in one respect, for it seems impossible to doubt that when the loss of life is finally counted up it will reach a larger total than has ever yet been due to a single earthquake. Up till now the Yeddo earthquake of 1703, with its reputed death-roll of 200,000, had stood in a class by itself, only in the crowded cities of China had 100,000 been reached, and in Europe tens of thousands had sufficed. The Calabrian earthquake of 1693 is said to have accounted for 93,000 lives in Calabria and Sicily, that of 1783 for 30,000 as the direct result of the earthquake and for another 10,000 by exposure, famine, and sickness, but the recent earthquake's death-roll can hardly have been less than 200,000 without counting the indirect consequences of the earthquake. In face of a calamity of this magnitude, and the magnificent, if somewhat agitated, outburst of charity which it has evoked, a calm investigation of such accounts as have reached us, and an attempt to extract from them information of scientific interest and value, must savour of cold-bloodedness; yet the human suffering will pass, the ruined cities will be rebuilt, for their existence and location are alike inevitable, but rebuilt, it is to be hoped, in a manner which will not make them death-traps, as were those which have disappeared. Not a tithe, nor the tithe of a tithe, of the loss of life on the morning of December 28 would have occurred had not the very sensible and practical regulations devised and enforced by the Neapolitan Government after the earthquake of 1783 been allowed to fall into abeyance; for this question of building construction in earthquake-shaken countries is no new one, and the simple instructions issued in 1784 might be adopted almost unchanged at the present day, with modifications in detail, consequent on the introduction of materials and methods of construction, which were not available a century ago.

Turning to the earthquake proper, the principal interest is in the comparision with earlier earthquakes in the same region, and especially with the great one of 1783, of which several detailed accounts by acute observers are extant. The area of destruction in each case seems to have

been much the same, Monteleone, Bagnara, St. Eufemia, Messina, Reggio, all were destroyed then as now, but in 1783 the destruction extended inland to regions from which no reports have yet reached us, whether because little damage was done, or whether because the newspapers have been too much occupied with the destruction of the more easily accessible towns on the coast, it is impossible to say, but the outer limits of the area over which the shock was felt were much the same in either case; both were felt throughout Sicily, and over all southern Italy as far as Naples in one direction, and Brindisi in another. From the particulars which have reached us, it is evident that the earthquake, like those of 1905 and 1907, was polycentric, that is to say, there were several detached areas of destructive violence, but it would be useless at the present moment to attempt their definition. This is a common feature of earthquakes in southern Italy, and will probably be found a more common feature of earthquakes in general than is commonly accepted as yet.

Another resemblance between the two earthquakes is the occurrences of a great sea-wave in each case, and in each case the wave accounted for a material proportion of the deaths. In 1783, at Scylla, only 4 persons owed their deaths to the earthquake, but no less than 1444 were killed by the sea-wave. In 1908 much the same seems to have been the case, and along the coast of Calabria and the opposite shores of Sicily the wave swept in places with a height of 30 feet over the shore. At Catania, which suffered no damage from the earthquake, three children playing on the quays were swept away by the wave and drowned, and even at Malta the wave was noticed. A sea-wave of this character can only be caused by great displacements of the sea bottom, and careful survey may show that such changes have taken place, but at present the evidence is contradictory. Some of the accounts from Messina speak of subsidence, and of the quays being now level with, or below, the level of the sea, others of elevation, and of docks and creeks now standing dry, with boats stranded where before they were anchored, in water deep enough to float them. These accounts are not necessarily inconsistent, but till the ground has been scientifically examined we cannot say whether the phenomena reported may not be due to mere displacement of loose surface deposits and made ground. From the strait of Messina comes a report, by the captain of the *Hopewell*, that sounding showed the sea-bed to have risen 10 feet, a statement which is not improbable in itself, but requires verification by detailed survey.

The behaviour of Etna appears to have been very similar in both cases. One account of the recent earthquake mentions that some light vapours had been noticed on Mount Etna the night before, and in 1783 the crater is said to have given out a considerable quantity of vapour towards the beginning of the earthquakes, but in neither case was the earthquake associated with a great eruption of the volcano. Yet another point of resemblance may be found in the fact

that in each case there was not merely a single great shock, but a group of them; in 1783 the shocks followed each other on the 5th, 6th, and 7th February, and though the earthquakes of 1905, 1907, and 1908 were separated by longer intervals of time, they seem equally to belong to a group of shocks which probably, like those of a century and a quarter ago, have relieved the strains in the crust of the Earth and, when the

inevitable after-shocks have subsided, may lead to a respite from disastrous earthquakes.

It would be useless to follow up the analogy further. The investigation of the late earthquake is in the capable hands of Prof. Ricco, and will doubtless be studied by others of the enthusiastic band of seismologists in Italy, who may be trusted to keep in sight this unique

opportunity for comparative study of two great earthquakes affecting the same locality, and showing so great a resemblance in their origin and in their consequences.

THE METEOROLOGY OF THE "DISCOVERY."*

This volume sets forth the results of the meteorological work of the *Discovery* expedition, discussed by various members of the staff of the Meteorological Office and by other specialists, and contains abundant evidence of the high value and great utility of the work.

Lieut. C. Royds describes the instruments and their exposure. In the sketch-map on p. 16, illustrating the position of Winter Quarters and other points of observation, we note that the ship is designated "H.M.S. *Discovery*," a slip which we think could hardly have been made by one of the officers of that vessel. Dr. Wilson contributes a few beautiful coloured plates of solar phenomena (haloes and parhelia), fog-bows, Earth shadow, clouds, and of the clouds and smoke of Mount Erebus.

The instrumental readings taken on board the *Discovery* on the voyage, at Winter Quarters, and on the sledge journeys are given *in extenso*, and make up the greater part of the volume. Captain Campbell Hepworth, C.B., discusses the climatology of South Victoria Land and the neighbouring seas, dealing with the mean and extreme conditions recorded by the *Discovery*, the other contemporary expeditions, and the expedition of Sir James Ross in the *Erebus and Terror*. The results are grouped according to seasons for the various areas in which observations were made, and although there is no attempt to deduce the normal climate of the Antarctic Regions, a great many valuable remarks are made on special points. Captain Hepworth is of opinion that the rise of temperature accompanying gales from a southern quarter is not due to the föhn effect which has frequently been called in to elucidate the phenomenon, but to the existence of a large cyclonic circulation, by which winds carrying the warmth of milder seas below in a curved course from the north, and have not altogether lost their higher temperature by the time when they sweep back northwards, after fetching a wide compass over the polar ice. The synchronous observations at Greenwich noon by the various expeditions and by merchant ships in the Southern ocean made it possible in several instances to demonstrate that Antarctic weather was affected by depressions travelling eastwards

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* 'National Antarctic Expedition, 1901–1904. Meteorology.' Part I. Observations at Winter Quarters and on Sledge Journeys, with Discussions by Various Authors. Prepared under the superintendence of the Director of the Meteorological Office, with the co-operation of a Committee of the Royal Society. London: published by the Royal Society. 1908.

which at the same time influenced the weather of Kerguelen. As regards the normal distribution of pressure, Captain Hepworth says—

"It seems not improbable, indeed, that from Cape Adare to Mount Longstaff, and even still farther to the south, the distribution of pressure conforms largely to the configuration of the high land, and that an area of relatively high pressure lies over the land to the westward of the coast ranges, and relatively low over the Ross sea, giving gradients for southerly winds during the greater portion of the year. The tendency for the formation of a pressure gradient, with isobars along the coast-line, is generally noticeable wherever land meets sea, and may probably be attributed to the temperature gradient between the land and the water."

Dr. Charles Chree, F.R.S., contributes a mathematical discussion of the temperature observations at the *Discovery's* winter quarters. This throws into relief the extraordinary variability of the temperature, a sort of "oasis of warmth" often appearing in the middle of an intensely cold period. The discussion of the two-hourly readings showed that a distinct diurnal periodicity occurred even in the perpetual night of winter. The greatest daily range of temperature usually occurred in winter, when the maximum range reached 27° to 41° in 1902, and 40° to 43° in 1903, though the greatest range on any day was 44°·5 in September, 1902. The least daily range occurred in the midsummer month, December, when the minimum range was only 3°·8 in 1902 and 5°·5 in 1903.

Mr. W. H. Dines, F.R.S., gives some important notes on open-air temperature, screen temperature, and terrestrial radiation. The mercury thermometer often showed temperatures below −40°, the freezing-point of mercury, and experiments made after the return of the expedition showed that mercury in a thermometer could be cooled down as a liquid, and continue to contract, considerably below freezing-point. He points out that the main feature of the monthly curve was the low temperature of the summer and the nearly uniform temperature of the five winter months, May to September. The monthly mean temperatures calculated from the two-hourly or four-times-daily readings, according to the data available—for in the time of stress in freeing the ship from ice the meteorological programme had to be reduced—are as follows for winter quarters:—

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
24·1	14·7	3·5	−12·0	−14·6	−14·9	−14·8	−16·5	−15·4	−7·7	13·5	24·6	−1·3

The low temperature of the Antarctic summer is remarkable, because the insolation is greater than at any other place at any other time, on account of the Earth being then at its nearest to the sun. During the whole two years while the *Discovery* was in the far south there were only five days with a mean temperature above freezing-point, and the precipitation never took the form of rain. Mr. Dines is inclined to

attribute the low summer temperature to the remarkably small amount of water-vapour in the atmosphere permitting of free radiation of heat into space. Mr. Dines goes over the ground already covered by Dr. Chree with respect to diurnal temperature changes, and many readers will prefer his less sternly mathematical treatment. He deals with the data from the physical standpoint, and shows that changes of barometric pressure must necessarily produce changes of temperature, and to this cause he is inclined to attribute the diurnal temperature range observed in the dark months. The black-bulb thermometer shows that the coldness of summer is not due to lack of sun-heat, for no other part of the world can match the difference between the temperature of the black-bulb *in vacuo* and that of the screened thermometer. The highest black-bulb reading, 154°, has rarely been exceeded in any part of the world, but on the day when it occurred in the Antarctic the maximum temperature of the air in the shade was only 24°·2.

Mr. Dines also discusses the humidity and evaporation observations. It was found impossible to obtain accurate measurements of the snowfall; but as even Mr. Mossman on the *Scotia* expedition, with all his experience in snow-measurements on Ben Nevis, and all his skill and resource as a meteorologist, could not satisfy himself as to the snowfall in the South Orkneys, we must allow that no addition to the staff of the *Discovery* could have secured better results in that direction. The measurements of the depth of snow showed that there was much loss by wind and some by evaporation, but practically none by melting, even in summer. The experiments on evaporation showed that the evaporation from ice in the Antarctic winter with a temperature far below zero is nearly twice as great as the average evaporation from a water-surface at Camden Square, London, at a temperature above 40°. This result can only be explained by the extreme dryness of the Antarctic air.

Mr. R. H. Curtis discusses the barometrical observations. He points out that the mean pressure for 1902–03 at Winter Quarters was 29·352 inches, and for 1903–04 it was 29·228 inches; while at Cape Adare in 1899–1900 it was 29·134 inches, on the *Belgica* during her drift in 1898–99 it was 29·307 inches, and on the *Gauss* in 1902–03 it was 29·134 inches. The question of the polar anticyclone, which requires a rise of pressure towards the south, could not be settled because no measurements of the height above sea-level could be made by levelling, and the decrease of pressure which was noted on the southward sledge journey might be entirely due to increased height above sea-level. It appears probable, however, that there was a rise in the surface of the ice-barrier of about 2 feet per mile. The diurnal range of pressure, though small, was distinctly traceable at all seasons, even in the winter.

Mr. Curtis also discusses the observations on wind direction and force at Winter Quarters. Classifying the observed wind directions for sixteen points of the compass, it is shown that 22·4 per cent. of the winds

were E.; 11·8 per cent. E.N.E., and 10·6 N.E.; *i.e.* 44·8 per cent. of the winds blew from between E. and N.E. On the other hand, only 0·5 per cent. of the winds blew from S.W., and none from W.S.W., W., or W.N.W. No less than 60 per cent. of the winds blew from between N.E. and S.E., only 3 per cent. between N.W. and S.W. In the upper air the wind direction, as shown by the smoke from Mount Erebus, showed that 76 per cent. of the winds were from between S. and W., and the movement of the upper clouds agreed well with this, the direction being rather more from the west. Gales were on the whole less frequent than on the west coast of Great Britain. Mr. Curtis also deals with observations of sunshine and clouds. The former were exceedingly interesting and quite new. The Antarctic summer gave not only a high total of hours of sunshine (490 hours for December, 1903), but also a very high proportion (66 per cent. in December, 1903) of the total possible. On several occasions continuous records of sunshine for 60 or more consecutive hours were obtained, the greatest being 87 hours, or nearly 4 days without intermission.

The last article in the volume is a discussion of the atmospheric electricity observations by Mr. C. T. R. Wilson, F.R.S.

The absence of headlines to the pages makes the volume peculiarly difficult for purposes of reference, and though detailed marginal notes are given in one of the memoirs, they are not supplied in the others, where their utility would have been no less.

Some statements made in the Introduction by the Director of the Meteorological Office as to the nature of some of the observations made by the officers and staff of the expedition cannot be passed over in silence, though a review is hardly the proper place in which to discuss them. The accuracy of the observations and the intelligibility of the records are, of course, of the first importance. Yet under Antarctic conditions and on an expedition mainly designed for geographical exploration, it would be unreasonable to expect that observers who were not professional meteorologists, and who had many other duties to attend to, should produce records as perfect, for example, as those maintained at an observatory like that formerly kept up on Ben Nevis. If Dr. Shaw found that such a standard has not been reached, it was no doubt his duty to say so; his task, we fully admit, was a difficult one, and he has done it well. Still it is unfortunate, in our opinion, that some member of the staff of the expedition was not retained officially by the committee and formally associated with the Meteorological Office in discussing the results. If this had been done, it is inconceivable that a doubt which is expressed as to whether certain wind directions are magnetic or true could have remained. The doubt, it so happens, affects a crucial point concerning the theory of the circulation of wind round the south pole, and is thus much to be regretted.

H. R. M.

LAKE KIOGA (IBRAHIM) EXPLORATORY SURVEY, 1907–1908.*

By Lieut. C. E. FISHBOURNE, R.E.

In May, 1907, a survey party, consisting of Lieut. Hall, R.E., myself, and two non-commissioned officers of the Royal Engineers under Captain A. G. Stevenson, D.S.O., R.E., was dispatched to Uganda to carry out the preliminary reconnaissances of routes for the proposed Uganda railway extensions. I and the two non-commissioned officers were detached from the party to make a rapid survey down the right bank of the Nile from its source at Ripon falls (Jinja), and to make an exploratory survey of Lake Kioga and the surrounding districts. The triangulation was based on two of the Anglo-German boundary commission trigonometrical stations: one on Buvuma, an island near Ripon falls, the other on Marongo hill, a point on a promontory some 20 miles east of Buvuma island.

Some difficulty was experienced in commencing work on account of the sleeping sickness; Buvuma island is probably the most infected place in the sleeping-sickness area (10,000 natives of the island have succumbed to the disease in the last seven years), the island consequently is rigidly quarantined. As soon as the necessary permission had been obtained, we proceeded to the base points; we were, however, detained there three weeks before the first observations could be completed, on account of the lake haze. The first observations were not completed until August 22, 1908, and plane-tabling commenced on September 1, the triangulation being carried northwards through Usoga.

Plane-tabling was slow work in this district: the elephant grass grows to a great height, and the density of the bush and the regular undulations of the country prevented the survey stations being viewed from any distance. A large amount of labour had to be expended in clearing the tops of the hills, so as to render triangulation possible.

The Nile, for the first 35 miles from its source, is broken by a continuous series of rapids and falls; the banks are steep and fringed on both sides with a narrow belt of dense forest. The portion of Usoga along this stretch of the Nile, and for 20 miles east, is very sparsely populated, and is covered with dense elephant grass which has successfully resisted the spasmodic and indolent attempts made by the natives at clearing and cultivation. From Kakindu northwards the Nile is navigable to Lake Kioga; the banks are low, and the country becomes flatter and more open, and is thickly populated. There is a good system of native roads, which in the dry season are in excellent condition.

On November 22, 1907, 1100 square miles having been surveyed, the work was temporarily suspended, while I accompanied the Rt. Hon.

* Map, p. 240.

Winston Churchill, M.P., on his journey down the Nile. At Nimule I left Mr. Churchill's party, and, accompanied by Mr. Ormsby, of the Uganda Administration, started off to make an attempt to reach Mount Elgon by a direct south-eastern route, traversing the little-known districts of Acholi, Lobor, and Northern Bukedi, a distance of about 400 miles, and to execute a route-map (1 : 5,000,000) of the journey. We left Nimule on December 12, 1908. The route taken through the Acholi country from Nimule was south-east up the valley of the Unyama, Mount Laduong, Payera, Pader, Patonga, Labor (see Africa, 1 : 1,000,000, sheet 86). The Lobor mountains were reached on December 25, 1907. The Acholi district was easy to cross, and there was ample water *en route*. The natives were friendly and willing to help the caravan, and supplied them with food and guides.

The country looked bare and inhospitable; mile after mile, ridge after ridge of never-ending scrub jungle and thorn-trees, except where round the occasional villages a few acres had been cleared for the cultivation of grain, sweet potatoes, and small beans. The soil is not rich, and is of little depth; there is frequent rock outcrop, and the hills are rocky and bare. All the rocks and hills are formed of a hard type of granite. Iron ore occurs in large quantities in the Lobor mountains; it is smelted by the natives, who manufacture spear-heads and native hoes. The Lobor mountains and Nakwai hills were crossed at an altitude of 5600 feet by a well-defined track running eastwards through the mountains. The natives of Nakwai were friendly, though at first they were suspicious, as they are frequently raided by neighbouring tribes. The Lobor mountains appear to be one group of connected hills, and not two separate groups, as at present shown on the map. The chain of mountains Kamalinga, Nakwai, Lobor, Napong, Parabong, Kokoro, running north-west-west, forms the natural boundary between the Acholi tribe on the west and the Turkana and Karamojo tribes on the east. This division is very marked; the natives on the west side of the hills speak an entirely different language to those on the east side.

A peak of the Nakwai hills was climbed, and an excellent view was obtained over the plains which lie to the south and east. These plains are flat and unbroken, and covered with grass; they are, in the dry season, waterless. Sixteen miles away to the south and south-east the course of the river Assua could plainly be seen; of Lake Kirkpatrick there was no sign, except for a large patch of green grass 10 miles to the south, where the ground is evidently moist. There is probably only standing water there in the height of the rainy season. The local natives say there is no lake—that is to say, no open water.

On leaving the Nakwai hills, it was not found possible to keep on the direct south-eastern course towards Mount Elgon, owing to the foodless and waterless nature of the intervening plains. Food running short, it was found necessary to make rapid marches to reach Manimani,

a food *depôt* kept by Indians and Swahilis to supply their caravans which trade between Victoria Nyanza and the Abyssinian border. On reaching Manimani on January 1, 1908, the *depôt* was found deserted and the buildings razed to the ground. The Swahilis and Indians had gone, since, owing to the threatening attitude of the natives, the Government had ordered the withdrawal of the traders and the closing of the country to trade. Food, therefore, was unobtainable, and, the place being full of natives, it was thought politic to push on. Owing to the enfeebled and half-starved condition of the porters, it was found necessary to abandon most of the loads—tents, boxes, etc.—and a forced march was made to Kilim, a traders' camp 80 miles to the south, near the foot of the northern slopes of Mount Elgon; this distance was covered in forty-four hours.

The route-map was discontinued after leaving Manimani, surveying being impossible during the rapid night marching. The caravan reached Mbale, the Government station at Mount Elgon, on January 9. Thus the practicability of a direct route from the Nile provinces to Mount Elgon was established. The route taken between the Nakwai hills and Mount Elgon lay entirely in the Karamojo country. The country is bare and uninviting; water during nine months in the year is only obtainable by digging in the dry beds of the watercourses.

On February 1, 1908, work on the Lake Kioga exploratory survey was resumed and the triangulation carried northwards through Usoga and along the southern shore of Lake Kioga from the entrance of the Nile on the west to the estuary of the Mpologoma on the east. The triangulation was then carried across the lake to Mount Kaga, and round the east shore through the Serere and Siroti districts as far east as Lakes Salisbury and Gedge, and as far north as 2° N. lat. The districts lying between Lakes Kwania and Kioga, and those lying east of the former, were explored. The country lying to the north and east of Lake Kioga is divided into three main divisions—

1. Bukedi, east and north-east of Lake Kioga.
2. Bumiro, north of Lake Kioga.
3. Lango, north-west and west of Lake Kwania.

1. The Bukedi district consists of very gently rolling plains with broad, shallow, marshy valleys with occasional rock outcrops rising 40 and 100 feet above the level of the surrounding country. Lake Salisbury lies in a shallow depression of the plains, and is fed at its eastern end by streams from Mount Elgon and by the water which slowly drains through broad grassy marshes from the higher levels of the plains to the north-east and south. The water from the lake flows out at its extreme western end, and gradually finds its way through broad grassy marshes in a south-westerly direction, and drains into the Mpologoma near its mouth. This outflow, the Basina, has occasional patches of open water, but is, for the most part, entirely blocked

by grass, weeds, and papyrus, and is at present unnavigable even by the smallest canoes. "Lake" Norman is really only an open patch of water on the Basina. There is no connection between the water of Lake Salisbury and that of the north-eastern arm of Lake Kioga; the watershed which divides the Basina from that arm turns northwards after passing Siroti, and effectually divides the two basins.

North and north-east of Komolo and Teso, districts lying north of Lake Salisbury, are large scrub jungle plains, waterless in the dry season, which stretch north to the Nakwai hills, and eastwards to the Kamalinga hills and Mount Debasien. The whole of Bukedi is densely populated. The language spoken is akin to that of Karamjo, which is a bastard form of the Masai tongue.

2. Bumiro. This country, inhabited by the Umiro tribe, is very large; it extends from Lake Kioga as far north as the river Assua, westward to the Acholi border, and east as far as the waterless plains of Karamojo. The district lying between Lakes Kioga and Kwania is, with the exception of the lake-shores, waterless, uninhabited, and covered with scrub jungle. On the north shore of Lake Kioga there are only a few Wanyoro settlements. The shores of Lake Kwania are, however, densely populated and fringed with a continuous belt of cultivation. The north shore of Lake Kioga, east of the Lake Kwania entrance, is practically free from papyrus, and landing is easy anywhere along the shore. This is due probably to the current of the Mpologoma river, which, on reaching the lake, runs north-west, and, striking the northern shore, sweeps along it, keeping it free from the usual belt of papyrus. The southern and eastern shores of the lake are bordered by a broad belt of papyrus, weeds, and floating sudd islands. The mouth of Lake Kwania is, as a general rule, completely blocked by sudd islands and papyrus. Natives report that there are, however, through channels for canoes right up to the extreme western end of the lake.

On July 25, 1908, the work had to be stopped, owing to my contracting "blackwater" fever. By this date 3500 square miles had been surveyed (1 : 125,000), and a further 1200 square miles on the north shore of Lake Kioga (exclusive of the Nimule-Elgon route exploration) had been explored, and a portion of it triangulated. We were unfortunate in having to work in Usoga during the worst stages of the famine which raged in the early part of 1908. Delay was also caused in Bukedi by outbreaks of pneumonic plague and small-pox amongst the porters of the caravan and the consequent temporary cessation of work.

Five-inch micrometer theodolites were used for the triangulation, the triangular error in Usoga being about 3″·4 per triangle. This error increased when observations were taken over the water of the lake, the final average error being 5″·3 per triangle. Indian clinometers and aneroids were used by the plane-tablers for the determination of heights. Sides of triangles varied from 12 to 35 miles.

SWALLOW-HOLES IN CHALK.

By Colonel W. PITT, (late) R.E.

THE following notes made during the summer of 1908 are intended to supplement the information given in the papers on "The Formation of Valleys in Porous Strata," by Mr. F. Bennett and the Rev. E. C. Spicer, published in the *Geographical Journal* for September, 1908. The area to which the notes refer is situated on the range of chalk hills in Hampshire lying between Alton and Basingstoke, and measures 6 miles from east to west and 2 miles from north to south. In the eastern half of this area the hills are in the form of a ridge with a maximum height of 740 feet, sloping gently towards the north and abruptly to the south. To the west the ridge broadens out into a plateau, the general level of which is about 600 feet above the sea. The formation is Upper Chalk with flints. The hilltops are covered by a clay cap with a maximum thickness of some 10 feet. This cap has been denuded from the slopes, and does not reach below the 500-feet contour. The chalk dips to the north. Approximately one-third of the area is covered by woods, some of them of great extent. The remainder is arable and pasture land, the latter predominating. The timber is almost entirely beech. There are no commons or unenclosed downs, but the size of the fields is remarkable, often from 80 to 100 acres, and some are very much larger. The area under consideration is riddled with swallow-holes, 118 being marked on the 6-inch O.S. map, all called "Old chalk-pits." These holes are very much alike in form, usually roughly circular or elliptical in plan, with the greater diameter from 100 to 200 feet, and the depth from 10 to 30 feet. In section they are shaped like a crater, with steep sides and slightly rounded bottom. Almost without exception they have trees growing in them—generally beeches, which are often of great age and size. A few of the holes have undoubtedly been used as chalk-pits. In such cases a roadway for carts has been made down the side, so that the chalk can be got out. It is quite obvious that the holes existed first, and that the roadways into them were made afterwards.

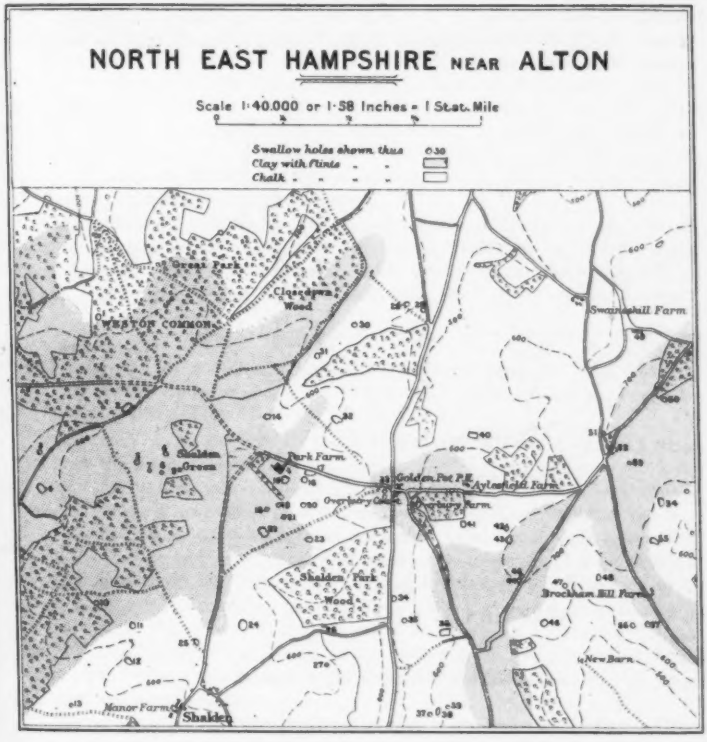
There are, besides those shown on the O.S. maps, numerous other holes in the form of shallow basin-like depressions. These appear to be swallow-holes in the early stages of their formation. They differ from those of a more mature age in having gentle rounded slopes instead of scarped sides, and are without trees or bushes growing in them. Sometimes they are so shallow that they would escape notice unless they were being sought for. In arable land the plough is run across them. Owing unfortunately to lack of time, I was unable to measure and locate more than a few of these holes. They are marked on the accompanying map, and their dimensions are given below :—

No. on map.	Length.	Breadth.	Depth.
	feet.	feet.	feet.
7	62	62	2
8	53	31	4
6	51	36	1
9	95	90	5
18	100	80	7
19	100	80	5
21	115	90	4
20	170	150	6½

No. 20 is in sloping ground ; the depth given is the mean.

It is a remarkable fact that no relation can be established between the lateral dimensions of these depressions and their depth. Apparently, the process of solution causes them to assume nearly their maximum width in the earliest stages of their formation, and to go on increasing in depth until the sides fall in and become more or less vertical. Probably some slight increase of width is caused by the weathering of the sides, though this would seem to take place less rapidly than the sinking of the bottom.

There does not seem to be any connection, with one exception, between the swallow-holes and their surroundings. They occur with equal frequency on level and sloping ground, where the clay cap exists and where it does not, but they are

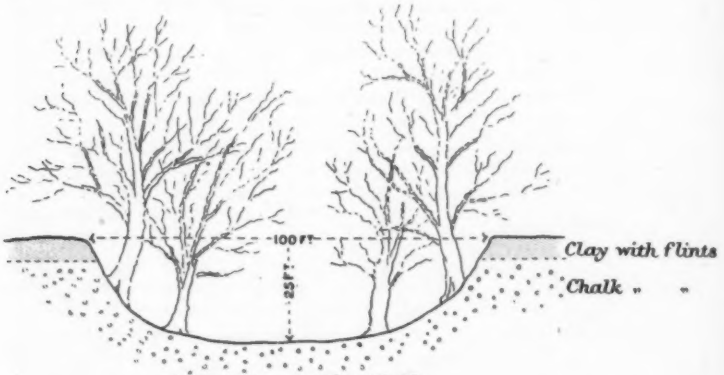


hardly ever found in woods. Surely this is something more than a coincidence. The inference would appear to be that the woods existed before the holes began to form.

The swallow-holes in this district appear to have been formed entirely by downward solution. The saturation level of the chalk, as proved by the depths of the few existing wells, is some 300 feet below the surface; there can consequently be none of the artesian conditions and upward hydrostatic action of water under pressure, described by Mr. F. J. Bennett in his paper referred to above, as existing in the neighbourhood of Maidstone. The swallow-holes are all dry, with the exception of a very few which may have been puddled; and there are no

indications of subterranean watercourses. In none of the dry valleys are there bourne holes; nor can connection be traced between the swallow-holes and the valleys, except in possibly one case, where a series of seven holes occurs following more or less the line of the bottom of a valley, extending over a distance of about a mile and a half. This may, however, be merely a coincidence, just as would appear to be the occurrence on the 700-feet contour-line of a ring of eleven holes.

It will be noted that none of the swallow-holes exceed a depth of about 30 feet. The Rev. E. C. Spicer, in his paper already referred to, mentions that some of the holes in the chalk of the Chilterns are 80 feet deep. Assuming that the rate of depression is approximately the same on the Chilterns as in Hampshire, the inference would seem to be that the former were raised to their present level long anterior to the elevating of the chalk hills in north-eastern Hampshire. The process may, however, have had its ordinary course interfered with by the Glacial age and a resulting ice-cap.



SECTION OF HOLE Nº 23

SECTION OF HOLE Nº 21

Scale 1:500 or 1 Inch = 41·7 Feet

The shallow depressions which have been described have a great resemblance to dry dew-ponds. They cannot ever have been artificial dew-ponds, because they are often found close together. I offer, for what it is worth, the suggestion that dew-ponds are immature swallow-holes which have been puddled.

The accompanying map, reduced from the 6-inch O. S., includes the central portion of the area referred to in these notes. Sections are given of a mature swallow-hole and another in the early stages of formation.

REVIEWS.

EUROPE.

Mountains of Northern Spain.

'Aux Picos de Europa (Asturies).' Par Fontan de Négrin. Toulouse: E. Privàt. 1907. Pp. 72. *Price* 3*s*.

A brief description of the singular group of limestone (dolomite?) peaks which crown the chain of the Cantabrian Pyrenees between Oviedo and Santander, and rise to a height of 2642 metres (8667 feet). The author was not successful in his climbing attempts, but translates a thrilling account of the first ascent of the Naranjo de Bulnes, the steepest but not the loftiest of these summits, by the Marquis de Villaviciosa. A photograph shows that this rock tower rivals in form the boldest of the Tyrolese dolomites. These highlands are destitute of accommodation and food, and their explorer must carry a tent and provisions. There are some iron-mines worked by Englishmen at Covadunga, on the northern slope of the mountains. The upper region is frequented only by izards, and is preserved as a royal hunting-ground. Further details may be found in the 'Annuaire du Club Alpin Français, 1897.' A map would have added greatly to the value of this sketch of an hitherto unused playground.

It is interesting to find the following Alpine terms in this remote region: *Canal*, valley (cf. canale, Venetian Alps); *majada*, a shepherd's hut (cf. Swiss maien); *oule*, a limestone hollow (cf. Swiss ouille); *pan*, a pass (cf. numerous variations of "pen," "peña," "pania," etc., the word being used, like "mont," for peak or pass).

Landslips in Italy.

'Studi Geografici sulle Frane in Italia.' Dott. Roberto Almagià. (*Memorie* of the Italian Geographical Society, vol. 8.) Roma: presso la Società Geografica Italiana. 1907. *Price* 8 *lire*.

It is intended to publish a series of volumes on this subject, the present, which deals with the northern Apennines and the Romano-Tuscan Anti-Apennines, being the first. In 1901, at the Italian Geographical Congress in Milan, General Carlo Porro, discussing the unsolved problems of Italian geography, placed in the front rank the question of landslips, and lamented that no thorough investigation had been made of these phenomena and their distribution, which might pave the way for engineering works and other means tending to minimize the disastrous results of this scourge of the country. At length, in 1903, the Geographical Society, at the instigation of the president, Prof. Dalla Vedova, took up the question and made inquiries through the officials of the ministries of Agriculture and Public Works. Dr. Almagia was invited to work up the material collected, and also made some personal investigations.

The map on which the distribution of landslips is marked shows at a glance that they are far more numerous on the flank sloping to the Po and the Adriatic than on the western side. The zone of country subject to frequent landslips, often of very considerable magnitude, extends from the river Curone eastwards to the Sillaro, and even beyond this river there are some districts where great disturbances take place, but on the Tyrrhenian flank there is no such continuous zone, and few of the disturbed districts can compete in the magnitude and frequency of the phenomena with the landslip zone of Emilia. The falls evidently occur chiefly, but not exclusively, in formations with an argillaceous base, for the most part of Tertiary age. Laminated clays of Secondary or Tertiary age are the most important in this respect, and then the flysch of the Upper Eocene. This explains

the lesser frequency of landslips on the Tyrrhenian flank, for there the typical laminated clays are almost absent, and the outcrops of flysch are much more limited than on the other side of the Apennines. Landslips occur in the hills near the Po, but on the whole are rare below 300 metres (980 feet); between 300 and 600 metres (1970 feet) they are evenly distributed, but they are most common in the zone between 600 and 1200 metres (3900 feet).

One chapter is devoted to the relation of landslips to rainfall, and it is deduced, from observations on the Adriatic flank, that the autumn maximum of landslips (in December) lags behind the rainfall maximum (October to November); that the spring maximum of landslips (March) precedes the rainfall maximum (April to May); and that the spring maximum is most prominent as regards landslips, the autumn for rainfall. The first result is not unexpected, for the rain must have time to soak through the permeable rocks, and the latter may be accounted for in part, at least, by the action of snow-melting and frosts. The author also touches on other contributory causes, as earthquakes, the action of man in deforestation and the construction of roads and railways, but refrains from expressing definite opinions until investigations have been carried out in other parts of Italy. From the evidence so far obtained he is disposed to believe that their action is very limited.

W. A. T.

ASIA.

China.

'Comprehensive Geography of the Chinese Empire.' By L. Richards. Translated and revised by M. Kennelly. Shanghai: T'usewei Press (London: Luzac & Co.). 1908. *Price* 12*s*.

The title of this volume is far from indicating its full scope; it is a compendium of things Chinese, including under the heading of Political and Economic Geography an elaborate treatment of history and administration such as is not usually found in a text-book on geography. The definitely geographical sections take the form of a description of China province by province, arranged under headings—area, population, hydrography, and so on. The mass of topographical detail tends to obscure the general outline, so that the book is more useful for reference than for systematic study. Its value lies in the fact that it puts in a compressed form, and renders accessible to the ordinary reader, facts and conclusions scattered up and down the varied literature of Chinese geography. A glance at the full bibliography attached to each chapter proves the real need of such a guide and compendium. A dictionary of cities and towns and an appendix on the meaning of Chinese geographical terms should go a long way towards removing the difficulty encountered by the uninitiated in dealing with Chinese terminology. The volume contains some useful maps and statistics, and seems to be carefully indexed.

A. J. S.

AMERICA.

Resources of Northern Canada.

'Canada's Fertile North Land.' Edited by E. J. Chambers. Ottawa: Government Printing Bureau. 1908. Pp. 139. *Illustrations and separate portfolio of Maps.*

This is a collection, presented in a somewhat more palatable form than that to which we are accustomed in Government publications, of the "evidence heard before a select committee of the Senate of Canada, during the parliamentary session of 1906–7, and the report based thereon." The names of those from whom evidence was taken include many well known here, and the volume contains every sort of geographical and economic information of the utmost value. Moreover, the portfolio-volume contains a series of maps, topographical, climatic, and economic,

which, in the present state of knowledge, could not be surpassed. That illustrative of mineral products is especially fine. No student of the northern territory of the Dominion should overlook these two compact volumes.

British Columbia.

'La Colombie britannique.' By Albert Métin. Paris: Armand Colin. 1908. Pp. 431. *Maps and Illustrations.* 12 *francs.*

This is a book of a type which would be welcome in an English translation. Its author, a professor at the École Coloniale and the École des Hautes Études Commerciales, is already well known for his studies of other parts of the British Empire. The present volume is a model of systematic arrangement. It is illustrated by a number of clear diagrammatic maps and by photogravures, which, though somewhat roughly printed and hard, are effective and well chosen. It is fully indexed, has copious references to original authorities in the form of footnotes in the text, and has a separate bibliography. In the text itself the physical geography of the country is first reviewed according to divisions—the island-chain, the Coastal Range, the plateaus, the high mountains, and finally the far north of the province. Climate, hydrography, and forests are next considered; then the history of the colony and its Indian and white population, together with the subject of immigration. Fishing and hunting, forest industries, agriculture and mining, are then treated in succession. Finally, lines of communication are dealt with, and the country is reviewed according to economic regions—first the islands, especially, of course, Vancouver; then the coast; then the "railway belt," the "mineral belts" of the Kootenay and the frontier, the Caribou goldfields, the undeveloped area, and the far north, including Klondike. Statistics are freely used in tables and otherwise, but with judgment—they are usually given for the purpose of comparison over a term of years. As to the maps, a few of the subjects treated will show that they are well chosen, and that their scope is wider than is usual in works of this type. Thus, in addition to the ordinary geological maps, we are shown the extent of the icefield of the cordillera at the close of the Quaternary epoch, after Geikie and Dawson; there are several climatological maps; there is a map showing the limits of certain important trees, and others showing Indian centres and the distribution of their languages. A special word should be given in praise of the fulness with which the mining industries, their distribution, relative importance, and methods, are treated; but, on the other hand, there is no subject, of which treatment might reasonably be expected, which is omitted or scantily dealt with.

O. J. R. H.

Mexico.

'Mexico, das Land der blühenden Agave.' By Dr. Joseph Lauterer. Leipzig: 1908. *Price 7m.*

'Wirtschaftsgeographie von Mexico.' By Prof. Dr. Karl Sapper. Halle-a-S.: 1908. *Price 3.50 marks.*

Dr. Lauterer has travelled much in Mexico, and has also utilized well the available literary material in the libraries of Europe and America. As a result he has produced in a single handy volume a clear and concise picture of Mexico past and present. The first part deals with history and antiquities, the second with the character and habits of the people, and the geology, botany, and zoology of their country. A large number of excellent illustrations, with an elaborate and well-arranged bibliography and index, aid in rendering this volume a valuable handbook to a somewhat neglected region.

The second book is one of a series of monographs on applied geography. It deals, in an extremely compressed form, with the economic possibilities of Mexico,

with particular reference to German interests. The purely geographical sections are very slight; the greatest space is devoted to a discussion of trade and to columns of trade statistics. There is a short selected bibliography of the most useful authorities from the point of view of the author. A. J. S.

Central America and Peru.

'Les Richesses de l'Amérique Centrale.' By Désiré Pector (7.50 *francs*). 'Le Pérou Économique.' By Paul Walle (9 *francs*). Librairie Orientale et Américaine. Paris: E. Guilmoto. 1908.

Both these volumes are the product of the same ideas and tendencies. The existing French colonies, important as they are, do not provide for the man of business, the small capitalist, and the worker those opportunities which at one time were confidently anticipated. In Central and South America there is a field, already occupied in part by a Latin civilization, exploited by Germany, England, and the United States, and attracting the attention, now, of Japan. Here is a favourable outlet for French energies; the object of the authors and the series is to point the way. This object determines the character of the work. The authors are men of affairs and well acquainted with the regions which they describe. The treatment is practical and to a large extent popular. M. Walle, as an enthusiast, deals perhaps more intimately with the beauties of the land and the life, customs, and personal appearance of the inhabitants. His pictures of some of the less known of the aborigines are vivid and interesting. M. Pector devotes himself more systematically to communications, animal, vegetable, and mineral products, industry, finance, and the essential conditions of foreign exchange. For Peru we have photographs, for Central America statistics of prices and lists of commercial products. But both books accomplish their main purpose and provide a mine of information for the intending emigrant, merchant, or financier. Unfortunately, they are not indexed.

A. J. S.

AUSTRALASIA AND PACIFIC ISLANDS.

Dutch New Guinea.

'De Zuidwest Nieuw-Guinea-Expeditie 1904–5 van het Kon. Ned. Aardrijkskundig Genootschap.' Boekhandel en Drukkerij voorheen E. J. Brill. Leiden: 1908. Pp. 676. *Price* 8 *florins*.

An expedition was sent out in 1904 by the Dutch Geographical Society, for the purpose of exploring the south-west coast of Dutch New Guinea, and to reach, if possible, the lofty range lying to the east of the isthmus formed by Geelvinck bay, the Sneeuwgebergte, which was first seen in 1623 by Carstensz on the yacht *Pera*. Every assistance was given by the colonial authorities. Two steamers, the *Flamingo* and *Anna*, were lent to the expedition; the *Lombok*, *Valk*, and other vessels of the New Guinea administration were placed at its disposal when they could be spared from their usual duties; and the New Guinea officials willingly lent their aid. The leader of the expedition, Heer R. Posthumus Meyjes, and Dr. Koch made, in April, a preliminary cruise along the coast, during which the position of Cape Valsch, the south-western point of Frederik Hendrik island, was fixed, and found to lie in lat. 8° 26′ 31″ S. In September the expedition sailed from Soerabaja on the *Flamingo* and *Anna*, and on reaching the coast of New Guinea a search was made for some river-mouth where the ships could ride safely at anchor, and where a good waterway ran into the interior towards the Sneeuwgebergte. Some time was spent in the exploration of Oostbaai and the north river, by which the Lorentz expedition subsequently made its way into the interior (see *Geo. Jour.*, vol. 31, p. 417), but finally Etna bay was chosen as the starting-point for an excursion towards the Charles Louis mountains, as the western end of the main

range has long been called. The result was not very satisfactory. The leader, Captain de Rochemont, struck the Omba river, and followed it and its tributary, the Aru, to a distance of some 30 miles as the crow flies, east of Kiruru, the camp on Etna bay. The coolies were beyond control, spent a whole day in covering a few miles when bringing up provisions, and finally struck altogether, necessitating the return of the expedition. An elevation of 6600 feet was attained at the last camp, and several prominent points were fixed by cross-bearings. Meanwhile Heer Meyjes was engaged in observations on the coast-line. He connected his astronomical observations with those of Australia through Thursday island, and in many points rectified the former delineation of the coast-line. Pisang bay, named by Augustijn Dirks in 1679, could not be found by Heer de Jong in 1903, and its non-existence was confirmed by this expedition. The highest peak of the Sneeuwgebergte lies in lat. 4° 3′ 30″ S. and 137° 8′ E. long., and its height was fixed as 5100 metres (16,700 feet). There is some doubt about the Carstensz top, a little further to the north-east, the height of which was estimated by Heer Hondius van Herwerden, commander of the *Valk*, as not less than 5500 metres. Heer Meyjes also took part in a Government expedition up the Digóel river, which enters the sea to the north of Frederick Hendrik island, and was discovered in 1903 by De Jong. The furthest point attained was in 5° 49′·6 S. lat. and 140° 15′·5 E. long., at a distance of about 300 miles from the coast.

The proceedings of the expedition are narrated with great detail by Heer Meyjes and Captain de Rochemont, and are well illustrated by maps and photographs. The latter half of the volume consists of reports on astronomical and hydrographic observations, geology by Heer Moerman, meteorological and anthropological observations by Dr. Koch, lists of plants and insects, etc. An ammonite, of a species not recognizable owing to its damaged condition, is of interest as the first sure proof of the existence of the Mesozoic system in the south of New Guinea.

W. A. T.

Old and New in Fiji.

'The Fijians: A Study of the Decay of Custom.' By Basil Thomson. London: W. Heinemann. 1908. *Price* 10*s. net.*

Mr. Basil Thomson is already well known as the author of several charming books on the West Pacific, and once more we are indebted to him for an admirable book on native custom and belief—this time on the Fijians, among whom he lived with short intervals for ten years, occupying important executive offices. A fair amount has already been written about these interesting people, and though Mr. Thomson's book constitutes an important addition thereto, a good deal more has yet to be discovered and recorded. For example, Mr. Thomson reprints the clear account of the Mbau marriage system from the *Journal of the Anthropological Institute* (vol. 24, 1895), but from information recently received from Dr. Rivers (*Nature*, 1908, p. 394), we gather that this is not the only marriage system in Fiji. The Fijians are Melanesians, but the group of islands has for a long period been subject to Polynesian influence through the Tongans. "Polynesian infusion is strongest on the eastern margin of the group, and wanes with every mile we travel westward, until it is lost altogether." From 1790, if not earlier, an expedition to Fiji from Tonga was an annual occurrence; indeed, we learn that the *grand tour* for a Tongan gentleman included a campaign in Fiji. Mr. Thomson traces the rise of Mbau power: originally it was a humble tribe of sturdy mountain warriors of Vitilevu, who, partly through chance and partly through genius for intrigue, won its way within a century to the foremost position in the group. Mbau was at the zenith of her power in 1828; four years later a successful rebellion dethroned the chief, but his son Seru restored him to power in 1837. Seru's own party called him

Thikinovu ("the centipede"), which bites without warning; the usurpers called him Na Mbi ("the turtle-pond"), in allusion to the number of people who were killed and eaten by him; but the name by which he was generally known was Thakombau ("destruction to Mbau," or "Mbau is undone"), signifying the success of his *coup d'état*. The further history of Thakombau makes interesting reading, as the coming of the white man greatly complicated that remarkable man's career. Mr. Thomson's intimate and sympathetic knowledge of the people enables him to give us much precise information that is of the utmost value to the ethnologist and sociologist, and the contents of the book range through most of their family life, sociology, and government. One feature is the amount of space devoted to endemic diseases, leprosy, yaws, and tuberculosis, all of which are of anthropo-geographical interest. The great value of the book, however, is in the clear and impartial manner in which the author traces the effects of the contact of the white man upon the Fijian. The Government official with the best intention, and the missionary from the highest motives, have made many blunders through ignorance. Any transition from barbarism to civilization is a troublesome period, which is fraught with grave danger to social and private morality. In most parts of Eurasia the evolution was very slow, and was usually effected by the contact of peoples of similar race, or, at all events, the disparity between the civilizing element and the more backward population was not very great. In the Pacific the reverse has occurred. An overweening and energetic people, obsessed with the desire of supplementing native methods of action and thought, has forced itself on the autocthones, who were in a state of low barbarism. The white man was in a hurry to effect changes, his knowledge of the local conditions was often very imperfect, and in some cases it was considered preferable to sweep away the old, rather than to let the natives gradually work out their own salvation with the aid of the new example and precept. The results in some cases were not at all what were expected. Those who have to govern native races, and those who seek to proselitize, should read this illuminating account of the conflict of the new with the old. It strongly supports the view that Government officials and missionaries should have instruction in sociology and ethnology before engaging in their several vocations.

A. C. H.

POLAR REGIONS.

The Greenland Eskimo.

'The People of the Polar North: a Record.' By Knud Rasmussen. Compiled from the Danish originals and edited by G. Herring; illustrations by Count Harald Moltke. London: Kegan Paul, Trench, Trübner & Co. 1908. *Price* 21*s. net.*

Knud Rasmussen, 'Under Nordenvindens Svøbe.' Copenhagen: Glydendalske Boghandel. 1906.

Knud Rasmussen has described to us in popular language his experiences among "the most northerly dwelling people in the world, an unnamed group of Greenland Eskimo" who wander from settlement to settlement between Cape York, north of Melville bay, and Cape Alexander—approximately, therefore, between 76° and 78° N. lat. There appears to be a tribe of "inland dwellers" who possess neither kayaks nor dogs; indeed, they are terribly afraid of the latter. It would be most interesting if more information could be obtained concerning this mysterious folk, who may wrest the honour of "the farthest north" from the kayak hunters described by the author. The book is a delightful "regional study" of conditions of existence that appear particularly unattractive to those who prefer warmer latitudes and a life of less strenuousness and privation. In picturesque language Rasmussen describes the grandeur and beauty of a desolate land, and even the

howling gale and driving snow offer the joy of struggle; while the haven of the camp brings peace, there blubber supplies light, and external and internal heat, meat is eaten ravenously, and, lolling in semi-nakedness, the Eskimo tell tales and rest. The worst experiences were those when, weatherbound, with soaked musty clothes and drenched sleeping-bags, they sat under an uninviting dripping from blubber under an extemporized shelter. "Our feet are white and swollen from the damp, and we are cold. Our spirits are on the verge of a breakdown. . . . 'Talk, Knud, talk! There will be no standing it if we are both silent. Tell us something, no matter what!'" cried his companion. One Eskimo thrusts his head out and shouts to the spirits to "Stop the rain." Another reproaches the author with avarice. "You are so strange, you white men! You collect things you will never require, and you cannot leave even the graves alone. All this calamity is the revenge of the dead." With rare sympathy we are told of the hardships that are overcome by the cheery disposition of these happy and contented people. Life would be impossible for dour individualists, the exigencies of the environment necessitating friendliness and collectivism; these manifest themselves on all occasions, and even wives are lent to one another for varying periods. With care, the student can piece together a fairly complete picture of the everyday life of the people, and the short chapters on death, religious beliefs, retribution, magic, and magicians give further insight into their psychology, customs, and beliefs; but one would have liked definite information concerning their systems of kinship and inheritance, structure and regulation of society, and many other matters of ethnological importance. A considerable number of folk-tales are given, which incidentally throw a good deal of light on the customs and ideas of the people. "They are told in the houses [during the Polar night] when the Eskimo, after great banquets of raw frozen meat late in the evening, are digesting their food, and are heavy and tired. Then it is the task of the story-teller to talk his hearers to sleep. The best story-tellers boast of never having told a story to the end." Fortunately for the reader, they here appear in an abbreviated form. Some details are also given of the West Greenlanders and the more sophisticated East Greenlanders. There is a lavish supply of most admirable illustrations by Count Harald Moltke, the majority of which are excellent portraits of Eskimo, and thus furnish abundant material for the student of racial types. There are also a dozen capital coloured plates, from three or four of which we can judge of the variation in skin colour that appears to occur among the Eskimo. The editor likewise deserves much praise for his share in this valuable book. He informs us that Mr. Ramussen is intending to make "a six-years' tour along the whole of the north coast of North America as far as Alaska, with merely the slender Eskimo equipment of kayak and dog-sledge, for the purpose of studying at first hand the still-surviving remnants of a once numerous race." Memorable results should result from this hazardous enterprise, but the editor is scarcely correct in describing the Eskimo as "an unexplored people." He seems to be unaware of the great amount of excellent work already accomplished by our American colleagues. A. C. Haddon.

GENERAL.

Francis Galton's 'Memories.'

'Memories of my Life.' By Francis Galton, F.R.S. London: Methuen & Co. 1908. Pp. 339. *Price* 10*s.* 6*d. net.*

This volume is the highly condensed record of a long, busy, and multifarious life, and of a curious, ingenious, and, above all, statistical intellect. We must here confine ourselves in the main to geography and travel. But these have formed only two out of the many preoccupations, recorded in 183 books, memoirs, and

articles, of Mr. Galton's versatile mind. His last, and perhaps his favourite, pursuit has been the study of what he has termed "Eugenics." We cannot even find space for a list of the divagations of Mr. Galton's lighter moments. He has studied to very practical purpose thumbmarks and fingertips; he has compounded composite portraits of philosophers, poets, and lawyers; he has investigated the habits of avalanches, and ascertained the best kind of sack to sleep in out-of-doors. He has even instructed the world as to "cutting a round cake on scientific principles," and he confesses that while he appeared to be listening to a lecture at a R.G.S. meeting, he was in reality (see p. 278) engaged in measuring progressive boredom by numbering the fidgets of a section of the Fellows sitting opposite him.

Mr. Galton tells us that his object in writing his autobiography has been, not to relate picturesque incidents, but "to indicate how the growth of a mind has been affected by circumstances." Fortunately, for some readers at least, the traveller and the man have proved too strong for the philosopher. The one exception, in favour of a very thrilling escape, he proposes to himself to make at starting, finds many companions in subsequent pages. Egypt, Syria, and South Africa, each in turn affords strange and entertaining traveller's tales, which are none the worse for the assurance we feel that, coming from such a source, they must be precisely accurate. In one of these he illustrates amusingly a danger we do not remember to have found insisted on in his 'Art of Travel'—that of rendering one's self too agreeable among primitive peoples.

"I did my best to make myself agreeable, investing Nangoro with a big theatrical crown I had bought at Drury Lane for some such purpose. But I have reason to believe that I deeply wounded his pride by the non-acceptance of his niece as, I presume, a temporary wife. I found her installed in my tent in negress finery, raddled with red ochre and butter, and as capable of leaving a mark on anything she touched as a well-inked printer's roller. I was dressed in my one well-preserved suit of white linen, so I had her ejected with scant ceremony."

Mr. Galton drops by the way in these pages another practical "hint." A shy man, he tells us, when compelled to venture into company in which he expects to be "howled at," will find "his own self-respect, and somewhat the respect felt for him by others," increased by putting on his best clothes. Many travellers have found this to be true in wild or semi-civilized countries. It was reserved for Mr. Galton to astonish us by illustrating his thesis by an experience of his own at—of all places in the world—a meeting of the Royal Society!

The accounts of Mr. Galton's early travels are interesting, if only for the changes, particularly in the means of locomotion, they record. This subject attracted Mr. Galton so much that at a later period he planned and had made a map showing the distances *in time* from London of different parts of the globe. The rapidity with which it became obsolete was remarkable. But perhaps, of all the journeys recorded here, the excursion in which we would most willingly have joined is the shortest—that which was taken in company with Herbert Spencer and "an Oxford clerical Don" to Epsom Downs on the Derby Day! Herbert Spencer, we are told, pretended not to enjoy himself, but "repeated his experience on at least one subsequent occasion." Mr. Galton, true to his mission as a scientific observer, did not look at the race as it passed, but observed that "when the horses approached the winning-post, the prevalent tint of the faces in the grand stand changed notably, and became distinctly more pink under the flush of excitement." The reflections of the clerical Don are not recorded.

Mr. Galton's lasting claims as an explorer rest on the journey of about 1700 miles in South-West Africa, "through the countries of the Namaquas, the Damaras, and the Ovampos," which occupied him for two years, and won for him

one of the Gold Medals of the Royal Geographical Society. We may quote the traveller's own summary of the difficulties and hardships he encountered—

"This bald outline of a very eventful journey has taken little notice of the risks and adventures which characterized it, and are recorded in my book. They must be imagined by the reader, otherwise the following paragraph will seem overcharged, which it is not.

"I had little conception of the anxiety under which I had been living until I found myself on board the little vessel that took me away, and I felt at last able to sleep in complete security. I had, indeed, to be thankful that all ended so well. I did not lose one of my many men either through violence or sickness during the long and harassing journey. It was undertaken with servants who at starting were found to be anything but qualified for their work, who grumbled, held back, and even mutinied, and over whom I had none other than a moral control. The very cattle that were to carry me had to be broken in, and I had to call into service an indolent and cruel set of natives, speaking an unknown tongue. The country was suffering the atrocities of savage warfare when I arrived—tribe against tribe and race against race—which had to be stopped before I could proceed. I had no food to depend on except the cattle I drove with me, which might at any moment decamp or be swept off by a raid."

The Society's medal, Mr. Galton tells us, gave him an established position in the scientific world, and procured for him election as a distinguished person to the Athenæum Club and to the Fellowship of the Royal Society, a body which at that date took a larger view of science than it has seemed, to the public, to do of recent years. Before starting on his South African exploration Mr. Galton had consulted the officers of our Society, and shortly after his return he became a member of its Council, on which he was destined to sit for some forty years, serving successively as an honorary secretary and vice-president. At the committees at which so much of the business of the Society is transacted as well as at Council meetings, Mr. Galton was an assiduous attendant, and his presence was always serviceable. He had a natural sympathy with progress; at the same time his acute mind was apt to pick out and range together all the possible objections to any change. Once convinced, however, that a course was expedient, no one could be more helpful than Mr. Galton in carrying it out, or more delighted at its success. The extension of the work, and still more of the sphere of influence, of the Society during the years in which he was connected with it is the best proof that his critical and restraining power was not often over-exercised. In one important matter Mr. Galton reminds us that he acted as a pioneer. The Council had for some years been in the habit of supplying instruction in methods of surveying to intending travellers, and of giving prizes for geography to the boys on the naval training ships. Mr. Galton first induced his colleagues to initiate and support a movement for raising the place of geography in our national education. A medal was, at his instance, offered for competition among public schoolboys. This measure did not prove a success, since it led to the cramming of a few individuals rather than to any improvement in general teaching. But a start had been made, and, when the school medals were discontinued, the Council directed its attack on the citadels of English education, our ancient universities. In the following sentence Mr. Galton seems to us to underrate both the aims of his successors and the extent of the results achieved: "I believe the subject has now gained a firm footing in both universities. To say the least of it, a thorough knowledge of classical lands such as can be conveyed by first-rate maps, models, and diagrams must be helpful to classical students." To assist the classical scholar to realize the local conditions under which the ancients lived in the lands round the Midland Sea

is a very small part of the functions of modern geography as it is now understood at Oxford and Cambridge. It deals with facts and problems which affect not only the scholar, but the physicist, the historian, the economist, and the statesman. The impulse has spread to the provincial universities, to the public and the elementary schools, and scientific geography is now a recognized branch of knowledge throughout the teaching centres of Great Britain.

Mr. Galton's chief contributions to geographical literature have been his 'Tropical South Africa,' 1853, his 'Art of Travel,' 1855, two articles in 'Vacation Tourists,' 1860–3, which he edited, and the first edition of our Society's 'Hints to Travellers,' a useful work that has suffered expansion since at the hands of many editors, and has proved its utility by the exhaustion of many large editions.

Mr. Galton's retirement from active work was felt as a serious loss by his younger colleagues, as well as by the many personal friends he left behind him in Savile Row, and it must be a satisfaction to them to learn that he is still able to put to good use and enjoy an old age full of honours, and brightened by the interesting memories he here invites them to share.

D. W. F.

Text-Books.

'Elements of Geography. Part I. General Geography. By H. N. Stephenson, M.A. London: Ed. Stanford. 1908. Pp. 155.

An attempt to establish a connection between "regional" and "physical" geography by means of the organic sciences is the author's justification for adding to the "Babel" of text-books. The task is completed with some care, and there are some useful maps showing careful attention to temperature and pressure, but there is nothing very convincing in the treatment to justify another "general" text-book. The illustrations are such as one frequently finds in physiography text-books. The Gulf Stream still holds an unchallenged position off the coast of Norway. There is little real value in a mean annual rainfall map for teaching purposes.

'School Text-book of Geography.' By L. W. Lyde, M.A. London: A. & C. Black. 1908. Pp. 388; 83 *Diagrams*. *Price* 3*s*. 6*d*.

This book gives a review of general principles and world features expanded into a more or less regional treatment of the main political units. The book is closely written, and would need careful and close work, and many of its passages would be best summarized by the student by means of diagrams. The teacher would have to supplement many passages by oral explanation. Some of the diagrams are indistinct and would require too much study to elucidate their meaning, and that of the French waterways appears on its side. For teachers the book would be concisely suggestive in many parts, for boys too involved in many passages.

'Historical Geography on a Regional Basis.' Vol. 1, "The British Isles." Vol. 2, "Europe." By Ernest W. Dann, B.A. London: J. M. Dent & Co. 1908. *Price* 2*s*. 6*d*. and 5*s*.

In vol. 1 the author sets out the main geographical factors which have controlled the history of these islands. The account is clear, and owing to the summaries at the end of each chapter the main issue is never obscure. It will supplement the ordinary text-book of history, but does not pretend to be a substitute. The maps, few in number, are poor, and do not help the story. A series of diagrams, where possible, would have been preferable. The books are among the first text-books of their kind, and deal with a side of geography for which it is hard to find a place in a modern school curriculum. The effort is, however, much to be appreciated. Coming more particularly to vol. 2, it may be said that the summary is good,

though it would be better if, when the details are under treatment, the causative elements received more emphasis. As it is, we seem at one time to have before us a geographical work, at another a historical summary. This absence of causal connection makes it a difficult book for young students, but it has a strong claim to be placed in the class reference library wherever such exists. A useful "List of Authorities" is appended. The author is to be congratulated on his effort to widen the outlook of the geographical text-book.

'A Rational Geography.' Parts II. and III. By Ernest Young, B.SC. London: G. Philip & Son. 1908. *Price* 1*s.* 6*d. each.*

Part 1 was noticed in the April number. The same criticism as to lack of regional treatment is to be made. Consequently throughout the three years' course, though great care has been taken in the compilation and arrangement, and in the selection of charts, there is not any marked effort to produce a growth of geographical outlook. This is surely a pity. Why is map-reading postponed to the third year's course, while climate is treated in the first and second years?

'A Scientific Geography.' Vol. 1, "The World." By Ellis W. Heaton, B.SC., F.G.S. Pp. 305. London: Ralph Holland & Co. 1908. *Price* 2*s.* 6*d. net.*

In this, the first volume of seven, "The World" is broadly treated as an introduction to the other six volumes. Great care has been used, and the result is enhanced by the numerous diagrams which adequately explain the text. As a general survey the book by itself is to be commended, while at the same time as the background of succeeding volumes, some of which were noticed in the April *Geographical Journal*, it would be most valuable.

'Text-book of Geography.' By C. S. Fry. (University Tutorial Series.) London: W. B. Clive. 1908. Pp. xx., 406. *Price* 4*s.* 6*d.*

A compilation in sections has produced a severe type of "cram-book," which may enable students to pass examinations. It would need supplementing by several works designed for a broader treatment. Some of the railway maps are most incomplete and worthless.

'A Primer of Practical Geography.' By J. W. Henderson, M.A. Glasgow: R. Gibson & Sons. 1908. Pp. 123. *Price* 1*s.* 4*d.*

A small book based on lessons given in the class-room. Parts are helpful to a teacher who has not yet determined the amount of his or her "practical" geography. The preface suggests the use of the book for leaving certificate classes in higher grade and secondary schools. For this purpose it is of doubtful value.

'Regional Geography: Asia.' By J. B. Reynolds, B.A. London: A. & C. Black. 1908. Pp. 128. *Price* 2*s.*

This is another volume of the series started by the publication of 'The British Isles.' The diagrams render the book valuable, and are far more instructive than the text. The inclusion of comparative statistics is a good feature; but there is an absence of expansion of treatment which so often spoils books which are produced in a "series." Speaking generally, by the time say "Asia" is reached in a geography course, the treatment of the subject should be at least two years in advance of say Europe, and one would look for more maps such as could embody concisely the information, while the text should expand rather than explain these. The impression strikes one that the author writes to instruct teacher and pupil at the same time.

F. G. A.

SHORT NOTICES.

Africa.—'The Baganda at Home.' By C. W. Hattersley. (London: Religious Tract Society, 1908. Pp. xvi., 227. *Maps and Illustrations.*) The student of native races, especially those of Africa, has no better friend than the missionaries, who, from their intimate contact with these peoples, are able to give such close accounts of their characters and customs as are contained in this volume. And Mr. Hattersley's voice has already bean recognized as authoritative. In the present work he not only deals with the Baganda on the lines indicated, and with his own and his colleagues' work among them, but gives a retrospective survey of Uganda and its administration, a chapter on "the land and its products," and a useful notice of the nature of, and summary of the investigations which have been made into, the terrible sleeping sickness. The photographs are very good.

'In Morocco with General D'Amade.' By Reginald Rankin. (London: Longmans. 1908. Pp. xiv., 304. *Map and Illustrations.* 9s.) The author's important position as a war-correspondent should be sufficient guarantee of the excellence of his writing and the accuracy of his matter. In this volume, though military affairs bulk large, they do not exclude other subjects. We find, in particular, numerous allusions to the condition and habits of the natives. Education receives a chapter, and there is a brief but useful one on Moroccan coinage.

America.—'The Other Americans.' By Arthur Ruhl. (London: Werner Laurie. 1908. Pp. xii., 321. *Map and Illustrations.* 8s. 6*d.*) It is not a little curious to find that this American traveller, after a journey coasting South America as far south as Valparaiso to Buenos Aires, where he crossed the continent, besides making an excursion inland to Lake Titicaca, La Paz, etc., appeared almost in the light of a discoverer to his compatriots. There would seem to be a wider interest in this country in the matter of South America and its affairs, and the book should have attractions for many readers. It is a simple narrative of the author's journey; but much is to be learnt of many aspects of South American life, a considerable amount as to the opportunities for foreign settlers in the various republics visited, and not a little as to their histories. The descriptions of some of the towns and their various and varying characteristics are notably good.

General.—'The King's Highway.' By Reginald Ryves. (London: St. Bride's Press. 1908. Pp. viii., 96 (double columns). *Illustrations and Diagrams.* 5s.) This is a book entirely for the road-engineer. It is an expansion and revision of a series of articles which appeared in *The Surveyor and Municipal and County Engineer*, by the officer in charge of the technical section of the chief engineers' office in the Public Works Department of Madras. His paragraphs on the study of physical maps (climate and geology), and the connection between these subjects, with indications as to what maps would be of special use to the road-surveyor, will interest the geographer. Some of the diagrams might have been more clearly reproduced.

THE MONTHLY RECORD.

EUROPE.

Lapp Migrations between Sweden and Norway.—In a monograph published at Uppsala (Almqvist och Wiksells Boktrycheri) in 1908, under the title "De Svenska Nomadlapparnas Flyttningar till Norge i äldre och nyare Tid," Mr. K. B. Wicklund has collected notices of the migrations of the Lapps in summer across the Norwegian frontier, beginning with the narrative of Ohthere. From the earliest times the Lapps appear to have regarded the reindeer as their

personal property, and when these animals migrated in summer to the grassy mountains of the Norwegian coast, where there are no gnats to torment them, the Lapps followed. From the middle of the eighteenth century the reports of the movements of the Lapps are particularly full, and from these it appears that the districts where the Swedish Lapps pastured their herds were, in general, much the same as now, but in some places the extension of cultivation has pushed back the western boundary of the reindeer pastures towards the east. The times for crossing into Norway and back again are also much the same. The number of animals driven over into the Tromsö department is, however, much greater, while in the Nordland department—at any rate, in certain parts—the number has decreased.

Projects of Canalization in the Regions of the Moselle, Sarre, and Chiers.—This is the subject of an article, by Prof. B. Auerbach, in the publication of the Société de Géographie de l'Est (vol. **29**, 1e Trimestre). The canalization of the Moselle and Sarre, it is pointed out, is a measure voted in principle by the Prussian Chamber, and its completion is to coincide with the opening of the Rhine-Weser canal in 1912. In 1900 there were founded at Metz both a "Verband für die Canalisirung der Mosel und Saar" and a "Verein zür Wahrung der gemeinsamen Interessen der Saarindustrie," with a common organ, *Südwestdeutsche Wirtschaftsfragen*. An official board sitting at Treves is also considering a practical solution of the problem, complicated as it is with railway competition and traction monopoly. As a rival to the German scheme, Prof. Auerbach proposes Dunkirk as an outlet for the products of the region, an outlet to be rendered practicable by the junctions of the Nord canals with the Meuse and the Chiers. This project, included in the French programme of 1900, has just been taken into practical consideration by the manufacturers of Luxembourg, who, considering that the German undertaking would only partially satisfy their wants, have resolved on securing, in addition, a western outlet for their products. The line of a projected canal joining the rivers Chiers and Moselle has already been traced for 32 miles from Stadtbredimus, on the Moselle, to Rodange. A map, on the scale of 1 : 100,000, and a longitudinal profile, illustrate the technical side of the scheme.

Historical Cartography of North-Western Europe.—In an inaugural dissertation for the degree of doctor at the Friedrichs University, at Halle-Wittenberg (Halle-a-S.: Kaemmerer & Co., 1908), Herr Eduard Moritz treats of the development of the map of the North sea and Baltic lands down to Mercator. Most of the early maps discussed have been dealt with individually or collectively by commentators, but the study is of interest as taking up the material from a special point of view, and bringing into prominence such of the facts as bear on the development of knowledge of the particular region in question. As printed, the dissertation embraces only a section of the whole subject (though this is explained only in a small-type note that might easily escape observation), being almost entirely concerned with the delineation of north-west Europe, firstly on the early disc or wheel-maps (and others of their class), and secondly in the portolani of the fourteenth and fifteenth centuries. The maps of the first category naturally give but an imperfect picture of this part of the continent as a whole, though the author gives a merited word of praise to the relatively correct topography of England supplied in particular by Matthew Paris. He duly recognizes, too, that the inaccurate geography of these maps was due, not entirely to want of better knowledge, but in part to the tyranny of tradition. With regard to the portolani, or compass-maps, he shows how the extended navigation of the Italians at the beginning of the fourteenth century, due to the improvement of the compass, at once led to an advance in the mapping of the external coasts of Europe, though this rapid advance, as exhibited in the charts

of Vesconte and Dalorto, was followed by a period of comparative stagnation. Herr Moritz takes the main subdivisions of the region in turn, carefully analyzing the information contained in the several maps, and in one or two cases suggesting judicious corrections of previous identifications. Comparative lists of the names to be found in the principal types are also given. It may be noted that he unhesitatingly accepts Magnaghi's view of the identity of Dalorto and Dulcerti though this is contested by other authorities. He agrees, however, with Marcel in reading the date of the former's chart as 1330, instead of 1325. The paper bears evidence of a full knowledge of the previous literature on the subject, to which, when completed, it should form a valuable addition.

ASIA.

Cotton Culture in Asia Minor.—In a recent Parliamentary paper (Cd. 4324), illustrated by two maps, Prof. W. Dunstan takes stock of the agricultural capacities of Asia Minor (particularly with regard to cotton), their economic accessibility to Europe, and the important modifications in the sources of the world's cotton supply likely to be effected by the improved exploitation of the region. In Asia Minor, it is pointed out, there is an area, nearly equal to that of the present cotton area in Egypt, available for the growth of American cotton. For the more generally useful cotton of the ordinary type, as distinguished from the Egyptian cotton of superior quality, Britain at present depends almost entirely on the United States. Much capital has accordingly been of late applied to the development of cotton culture in West Africa. As yet, however, no large area comparable with that available in Asia Minor has been proved capable of growing American cotton. In Northern Nigeria the growth of such cotton is at best an affair of the indefinite future. Asia Minor is already served by four railways: the Anatolian, in actual running from Constantinople to Bugurlu, and to be continued to Adana; and those from Adana to Mersina, Smyrna to Kassaba, Smyrna to Aidin. The Anatolian line, with which the other lines are to be connected, is, moreover, in process of prolongation through Eastern Anatolia, across Mesopotamia, to Baghdad, ultimately to extend to the Persian gulf. The vilayet of Aleppo and the neighbouring Mesopotamian plain are credited with enormous possibilities of agricultural development. Should, then, the cotton-growing possibilities of Mesopotamia, in addition to those of Anatolia and other districts of Asia Minor, be realized, Prof. Dunstan predicts that their cotton production will rival that of the United States and India. The total cotton export from Turkey amounts at present to about half a million bales. Though in the three principal cotton-growing districts—two in the west, one in the Cilician plain—it is usually possible to grow the crop successfully without irrigation, yet the development of irrigation beyond its present primitive stage would result in a great increase both quantitative and qualitative. The authorized irrigation, *e.g.*, of the Konia district, is expected to bring 200,000 acres under cultivation. The American upland cotton or an American-Yerli hybrid would, it is conjectured, become the staple production. A more detailed account is given of the agricultural capacities of western Anatolia and the Cicilian plain, followed by a characterization of the cottons of Asia Minor and Syria. Interspersed are notes on climate and other subjects.

Indian Geodetic Operations.—The geodetic summary in the report mentioned in the January number (p. 88) records the extension of the principal triangulation westwards in Baluchistan from 64¼° to 62½° E., some difficulties being experienced owing to the abnormal conditions of refraction met with. In the western section the observers approached the volcano Koh-i-Taftan, in Persian territory, and the telescope revealed large volumes of smoke rising and spreading over its snow-capped

peaks, one of which rises to a height of over 13,000 feet. This bears out the local tradition of the mountain's comparatively recent activity, and is of special interest owing to the small account taken of this volcanic region in most of the text-books. Observations of Himalayan heights (see *Journal*, vol. **31**, p. 103) were continued during the year, the results showing that, as in the preceding year, refraction was greater in the autumn than in the spring. Some of the observations also gave the unexpected result that refraction was greater at 10 a.m. than at 8 a.m. Gravimetric observations were made on a line running south from Mussuri across the Siwaliks, and at all stations a deficiency in the force of gravity was observed, indicating an invisible deficiency of rock ranging from 3700 feet at the foot of the Himalayas, to 570 feet at the most southerly station, Gesupur. All the stations but this last would be placed below sea-level if the crust were reduced to normal density. An object of future work would be the determination of the exact position of the line, roughly parallel to the Himalayas, where the *excess* of gravity is a maximum. Observations in the hill regions of South India were contemplated during the next season. From observations of the deflection of the plumb-line carried out in and about the Kathiawar peninsula, a special source of attraction was brought to light within the peninsula, and, as might be expected, in a part coinciding with the central basaltic overflow. Among the levelling operations, a revision of the line to Mussuri, first carried out in 1904, showed an apparent sinking of the ground to the extent of 5 inches at that place and Saharanpur (or else a rise of 5 inches at Dehra) as a result of the earthquake of 1905.

Botanical Explorations in Fokien.—Although lying on the coast, and containing the two treaty ports of Fu-chou and Amoy, the interior of Fokien is still little enough known to offer an interesting field for detailed exploration, the interest in which is heightened by the wild and picturesque scenery of its forest-clad mountains and deep river-gorges. Botanically, it has remained almost virgin ground; for although small collections of plants have been made by one or two of the few travellers who have traversed the interior, Central Fokien had, until recently, never been visited by a professional botanist. In 1905 a short but interesting journey to the upper Min river was made by Mr. S. T. Dunn, superintendent of the Botanical and Forestry Department of Hong Kong, for the special purpose of collecting as many kinds of plants as possible, and the results are recorded in the *Journal of the Linnean Society* (Botany), No. 267, 1908. After preliminary work on the lower Min and Yuen Fu rivers, Mr. Dunn (who was accompanied by his wife and three native collectors) started up the former river, reaching in two days the lower end of the dangerous rapids which have done much to check intercourse with the interior. As these were ascended, the country, which had been open and cultivated, became enclosed by high mountains. At Yenping help was obtained from Dr. Skinner, of the American mission, and from this base explorations of the high, and in part forest-clad, mountains in the neighbourhood were made, while two of the collectors were sent up to Shao Wu, on the western borders of the province. The high-road from Yenping to Yenkau traverses a large patch of virgin forest, ascending a valley by a flight of several thousand rough stone steps to the pass above, the forest being replaced halfway up by rocky cliffs, between which the stream pours in a series of cascades. In spite of many difficulties, Mr. Dunn penetrated to all parts of the middle and lower forest, besides exploring the grassy downs above. In all, the number of species collected reached over 1400, including at least forty new species, and numerous other interesting plants new to the known flora of the province, or even to that of China. Descriptions of the new species accompany the paper.

AFRICA.

The Circumnavigation Scarabs.—The scarabs which, on the authority of M. Moret and Dr. Capart of Brussels, were accepted for a moment last summer as genuine records of a circumnavigation of Africa in the time of Pharaoh Necho II., have eventually brought their real authors into serious trouble. As was stated in a note to Prof. Petrie's article in this *Journal* for last November, their inscriptions were then already discredited. The exposure of the forgery was due to certain German Egyptologists, who, noting that the facts seemed to be a *cento* of correctly written passages, connected by other passages which were incorrectly written, tracked down the first-named passages to divers French publications of genuine hieroglyphic records of ancient travel. They drew the right inference that a forger had selected these, and tried to piece them together to make a new and startling record, but had failed, from lack of knowledge, to write the necessary linking phrases correctly. This inference they communicated to the recent Historical Congress in Berlin, and it was accepted by all the Egyptologists present. The Brussels authorities, convinced of the facts, proceeded against the vendor of the scarabs, the widow of the late M. Bouriant, who was head of the French Archæological Mission in Cairo a decade ago. They obtained judgment for the reimbursement of the £500 paid to the lady, but, unable to get payment, had to take further measures. On January 5 Mme. Bouriant was arrested in Paris with her son, who had also been concerned in the sale. It will be remembered that their story was that the scarabs had been found among the late M. Bouriant's effects. The result of the magisterial examination was to extort a confession from the son, that he had in fact found the texts written out among his father's papers, but had himself conceived the idea of having them inscribed on scarabs and palming these off on the world. He had carried out his idea with the help of a sculptor. Mother and son, says the *Times* correspondent, telegraphing on January 6, remained then in custody, and would in due course be brought up for trial. If the son's story is true, it would appear that the late M. Bouriant made this *cento* of hieroglyphics for his private amusement.

Mr. Gardiner's Further Explorations in the Seychelles.—Accompanied by Messrs. H. Scott and J. C. F. Fryer as naturalists, Mr. J. Stanley Gardiner set out once more for the Seychelles, in June last, to complete the work of the Percy Sladen Trust Expedition to the Indian ocean, the earlier doings of which have been fully dealt with in the *Journal*. From a short account communicated by Mr. Gardiner to *Nature* of December 17, 1908, we learn that after ten days' detention on Long island, the quarantine station, the travellers separated, Mr. Fryer visiting Bird and Dennis (two islands on the edge of the Seychelles bank, 70 miles north of Mahe), and subsequently proceeding to Aldabra and other islands north-west of Madagascar, while Mr. Gardiner and Mr. Scott went to Silhouette, the second highest island in the Seychelles (2467 feet), about 12 square miles in area, with rugged granite hills. It has two bays, with flats covered with coconuts, their existence being due to former fringing reefs, for the level of the island has changed to the extent of quite 30 feet within comparatively recent times. A similar change of level was found to have taken place on Mahe, and Mr. Gardiner's former impression that there might have been a more ancient elevation of about 200 feet proved erroneous. Mr. Scott's task was the collection of the insect fauna of the small patches of indigenous jungle still remaining on Silhouette and Mahe, and he remained for this purpose after Mr. Gardiner's departure. The islands visited by Mr. Fryer (whose preliminary report accompanies Mr. Gardiner's communication) form two groups—Assumption and Aldabra to the west, and Astove and Cosmoledo

further east—Assumption being a crescent-shaped bank, the other three atolls, of which the ring shape is well preserved in the case of Aldabra and Astenove, while only a few islands are left in that of Cosmoledo. On Astove the coral rock was interesting as still presenting the appearance that it had underneath the sea, the corals being in their natural positions. Wind-formed dunes, about 50 feet high, with shingle below the surface, were met with inland, and Mr. Fryer suggests that the north-west monsoon must have been stronger once, or cyclones more frequent, to have driven the shingle inland. Assumption has only lately become the site of a settlement, and everything is untouched. The rock is the same as at the other islands, but more changed. A striking feature was the presence of numbers of big pits (one 45 feet deep), with old mangroves growing in some of them. In one the remains of land-tortoises were found.

Forest Administration in Southern Nigeria.—A colonial report on this subject for 1906 (Miscellaneous, No. 51) has lately been issued. While no addition to the area of reserved forest in the western province is reported (the acquisition of reserves being hampered by the resentment of the inhabitants against any interference with their rights to land and its produce), in the central province the forests of Benin, Warri, Sapele, Agbor, and Ifon districts are now by law reserved for 1000 yards back along both banks of all the rivers. Since the close of 1906 a game reserve has been established near Gilli-Gilli. In the eastern province the proposed forest and game reservation of a large tract on the Oban block of hills has not yet been established. Some years must also elapse before areas on the hill ranges north of the Cross river can be taken up as reserves. Meanwhile the destruction of forest continues, and unless checked, will necessitate the creation of forest plantations. In the "dry zone" fires stunt the growth of young trees, destroy others, and, assisted by indiscriminate felling for farming purposes, are converting woodland into grass land. Inland, again, with an annual rainfall of not over 50 inches, the deciduous forest sheds a layer of very inflammable material, while, thanks to their rhizomes and pertinacity of life, the grasses are much better able than the trees to resist the ravages of fire. The ashes, moreover, get washed away, and the soil, gradually deteriorating, becomes incapable of growing anything except the coarser grasses. The export of forest produce in 1905 amounted to the value of £270,317 as against £100,813 in 1903. Included in the Report is an account of the progress of agriculture and particulars of the climate.

AMERICA.

Mr. Leffingwell's Explorations in North-West America.—We have received from Mr. Leffingwell, whose explorations in the far north of North America were begun several years ago in association with Captain Mikkelsen, a statement regarding the researches carried out by him during subsequent independent journeys, and of his plans for completing the work during the next few years. Although the original expedition was generally spoken of as under Captain Mikkelsen's leadership, it should be understood that Mr. Leffingwell contributed very largely to the expenses, and that since Captain Mikkelsen's return he has continued his explorations entirely on his own resources. The programme which he has set himself embraces the exploration of the area north of the Yukon-Arctic divide, and between the Colville river and the Canadian boundary; and in about four years he hopes to have ascertained the main geographical and geological features of that region. During the first two seasons (including the time during which he was working in association with Captain Mikkelsen) Mr. Leffingwell secured some preliminary results, including tidal observations for three months at Flaxman island; the mapping of a portion of the coast and about 100 miles of traverse in the interior; observations for latitude,

longitude (at headquarters by occultations), and azimuth; geological observations, including the collection of fossils, and the study of sections on the rivers; studies of the Eskimo vocabulary and grammar; meteorological observations for a complete year kept under his direction by the mate Storgessen, with notes on the weather during other years. He also took part in the ice-expedition of Captain Mikkelsen, and assisted in the soundings then obtained. In many directions the work is still incomplete, but Mr. Leffingwell hopes that its value may be considerably increased within the next few years, during which he will have the assistance of one or two other white men. At the time of writing (December 23, 1908) he was preparing for a new start.

Sir Francis Drake on the Coast of California.—Prof. George Davidson, whose well-known researches into the history of early exploration on the coast of California have been continued for many years, has lately returned to the subject of Drake's voyage on this coast, with special reference to the highest latitude attained.* This is commonly given as 48° N., on the authority of the narrative published by Drake's nephew in 1628, under the title, 'The World Encompassed,' though the latitude given by Hakluyt was only 43°. Prof. Davidson, whose competence in the matter is greatly enhanced by his unrivalled knowledge of the coast in question, protests vigorously against the idea that the latitude of 43° was passed, and it may be conceded at once that there are certain grounds for viewing with suspicion the statements that 48° was reached, though whether Prof. Davidson has succeeded in establishing his conclusion as entirely beyond question is another matter. We are told in 'The World Encompassed' that after reaching 42° on June 3, a sudden change from heat to extreme cold was experienced, and that on June 5 the navigators were forced by contrary winds to run in with the shore, where they stayed a certain time in an insecure anchorage, enveloped in thick fog. It is subsequently stated that this was in 48°, and that they coasted thence to 38° (where a secure harbour was at last found), seeing only low hills, but all covered with snow. Prof. Davidson maintains that to have beat up to 48° in the face of adverse winds would have been an impossibility, and though he is hardly justified in assuming that such winds were encountered immediately after reaching 42° (for they are not mentioned until June 5), the interval of two days available could not have been sufficient to carry the *Golden Hinde* to 48°, even with fair weather. The writer, however, is hardly correct in asserting that the above-quoted statement is the sole base for the claim in favour of the higher latitude. He may be thought, in fact, to weaken his case by a somewhat one-sided estimate of the comparative value of the early authorities. Thus, others who mention a latitude of 47° or 48°, *before* the publication of 'The World Encompassed' (*e.g.* John Davis, Stow the antiquary, John Drake who accompanied his namesake, and the anonymous writer whose narrative was printed in an appendix to the Hakluyt Society's edition of the voyage), are dismissed as entirely without weight, while complete credibility is attributed to writers who agree with Hakluyt, all or most of whom may quite well have derived their information from the last-named himself. The mention of the higher latitude by so many contemporary authorities argues, at any rate, a current belief that such had been attained. To some the extreme cold encountered may seem an argument in favour of this higher latitude, but its force is lessened by the fact that the narrator speaks equally strongly of the nipping cold when the harbour in 38° had been reached. Prof. Davidson seems inclined to regard the details given as largely fictitious, though, curiously enough, he justifies the

* *Trans. and Proc. Geogr. Society of the Pacific*, vol. 5, 1908; also separately as a reprint.

description of the climate in 38° by recent testimony regarding the prevalence of fog in this latitude (the question of temperature being ignored in this connection). Prof. Davidson also dissents from current views in regard to the "silver map" described by Mr. Miller Christy (which he denies to have been intended to commemorate Drake's voyage), and to the port discovered by Drake in about 38°, which he maintains was *not* the modern bay of San Francisco.

AUSTRALASIA AND PACIFIC ISLANDS.

Research in the Caroline Islands.—Dr. Krämer, who is well known for former research in the Western Pacific, and who took part in the voyage of the German Survey ship *Planet* to that region (*Journal*, vol. **29**, pp. 94, 575), has since paid visits for scientific research to various small island groups in the German Pacific, principally in the Caroline archipelago. He has given an interesting description of these, with notes on the present condition of the natives, in the *Mitteilungen aus den Deutschen Schutzgebieten*, 1908, No. 3. Among other points, some attention is given to the geographical nomenclature of the islands. During a short visit to the Lord Howe group (north of the Solomons)—the correct name of which is, he says, Loaniua—he was able to demonstrate that the inhabitants of the group are typical Micronesians, in close relation with those of the Central Carolines. The longest visit was that to the Truk atol in the latter group, a minute description of which is given by Dr. Krämer. It consists of a ring of high islands, the larger composed only of volcanic rocks, and almost all of them steep and densely wooded. An exception is the peak of Vidiboen, in the largest island, Vela, which is bare and has a gradual slope. It is composed of Amphibolite schist, and is better watered than most parts of the group. Vela has the form of a horse-shoe, open to the east, and its highest point, in the north-west, reaches a height of 1000 feet. Higher still is the smaller island of Tol, which name is an old word meaning "mountain," which is also the signification of Truk. The islands are stony and not much suited for agriculture, lowlands of any extent being also absent. A palm like the areca is characteristic of the mountain woods, but the areca itself does not occur, while the *Piper betle* and *P. methysticum* (kawa) are also absent, though the latter occupies a polynesian enclave at Ponape. Truk is *par excellence* the home of the bread-fruit, and Dr. Krämer made a collection of songs connected with its culture, with which the whole life and thoughts of the people are bound up. Though excessively lazy, the Truk people are not wanting in cleverness, and have a fine and healthy physique. With the introduction of the coconut the group might have a prosperous future before it, while the islands further west, Yap and the Palau (Pelew) group, present by contrast a spectacle of decay and depopulation. From a moral and social point of view, too, the Truk group has the advantage, and Dr. Krämer thinks that good might result from the introduction of these strong and healthy people into some of the depopulated islands. The article has a good deal to say, also, about the Yap and Pelau groups, especially the political organization of the former. Dr. Krämer says that Pelau is the correct form of the latter name, the word being applied to the red volcanic soil in contrast to the raised limestone reefs, which go by the name Kogeal, and are hardly ever inhabited. He gives large-scale maps of Yap and Babeldaob, showing in the latter case the distribution of the limestone.

POLAR REGIONS.

The French Antarctic Expedition.—A further communication from Dr. Charcot (cf. January number, p. 94) has been received, describing the final programme of the expedition as it stood on December 11, on the eve of starting from Punta Arenas,

where the coal-supply had been replenished from the stock deposited there. Arrangements had been made whereby the quantity used during the voyage by Ushuaia to Deception island (South Shetlands) would be again made good, so that the *Pourquoi Pas?* would leave the last-named point with full bunkers. After a short stay at Port Lockroy in the Palmer archipelago (where an attempt would be made to dig for fossils) and at Port Charcot in Wandel island, the expedition will make its way along the west coast of Graham Land towards Alexander I. Land, where it is hoped to winter, making explorations in various directions on the ice. In the summer of 1909–10 an attempt will be made to carry out further exploration by sea, after which a return will be made if possible to Port Lockroy, where Dr. Charcot hopes to arrange for a depôt of coal to be formed. In any case, this will be the spot which the expedition will endeavour to reach in case of disaster. In the event of being unable to give an account of himself by April, 1910, Dr. Charcot thinks that relief measures would be advisable. It is to be remembered that to push forward towards the pole is no part of Dr. Charcot's programme, his chief object being to explore the neighbourhood of Alexander I. Land as fully as possible.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Maps for Aeronauts.—We have received from Dr. Peucker of Vienna (who has also discussed the subject somewhat more fully in the *Geographische Zeitschrift*, No. 11, 1908) some notes regarding the progress lately made on the continent in the direction of providing special maps for aeronauts. The idea was mooted so far back as 1888 by Lieut.-Colonel H. Moedebeck, to whom therefore the "Fédération aéronautique," which held its third yearly meeting at Brussels in 1907, entrusted the task of organizing an international commission in furtherance of the proposal. The first official report on the work of this commission was printed last year in the *Illustrierte Aeronautische Mitteilungen* (Berlin). Nine countries (including India, represented by the meteorologist, Mr. G. T. Walker) have given their adhesion, and others are expected to associate themselves in the movement. Colonel Moedebeck's idea is to represent, in as conspicuous a way as possible, features of importance for the securing of a safe landing (including both spots to be avoided and spots to be chosen), as well as those calculated to aid orientation during flights by night or in fog (coast-lights, blast furnaces, fog-signal stations, etc.), or to be of assistance towards the continuance of the voyage (gasworks, meteorological observatories, etc.). All these would be marked in bright red by different symbols on existing large-scale maps. The scale of the map chosen for the purpose need not be the same for all countries, but should not in any case be less than 1 : 400,000, while for Germany the special topographical map on the scale of 1 : 200,000 seems likely to be accepted. Any information likely to aid in aerial navigation should be supplied, *e.g.* indications of the height and steepness of mountain ranges, and of the position of the lowest and safest passes. Colonel Moedebeck agrees with Count Zeppelin that the organizations best qualified to undertake the production of such maps are the various national survey departments. For Belgium, the Liebenow map, in one hundred and sixty-four sheets, on the scale of 1 : 300,000, issued by L. Ravenstein of Frankfurt on Main, has been definitely adopted as a basis, and it is proposed to add to this map a representation of relief by contours of altitude. The colouring of such maps can no longer be regarded as a mere matter of convention, but must follow a definite scientific principle, such as was first employed by the Austrian, Von Hauslab, and is followed in the excellent contoured maps of Bartholomew. The latest developments of this principle (cf. *Journal*, June, 1907, p. 680) will enable the forms of the land to be represented in a way that will meet all the requirements of the aeronaut.

The Freezing of Lakes.—Some interesting notes on the phenomena connected with the freezing of lakes are supplied by Mr. E. M. Wedderburn in the last annual issue of the *Journal* of the Scottish Meteorological Society. The writer, who has done much good work as an assistant of Sir John Murray in the Scottish Loch Survey, calls attention to the fact that a lake rarely freezes until the whole body of water has been cooled considerably below the maximum density point (39°·2 Fahr.); and he accounts for this by the influence of the wind, which has a far greater effect in thoroughly mixing the water than is sometimes supposed. Inquiry showed that lochs of a greater depth than 200 feet are seldom covered with ice until the end of January or February, although their temperature will have reached the maximum density point by the end of December at latest. In spring, however, lochs will often freeze over in a single night, though they have not once been frozen during winter. In such cases, the freezing generally takes place on calm and clear nights, favourable to sharp dry frost. It was found that instead of beginning near the shores and gradually spreading towards the centre, isolated patches of ice may be formed at some distance from the shore, especially on calm nights. The patchy appearance thus caused may be due, to some extent, to the shelter from breezes afforded to some portions of the surface by surrounding hills, or to cold river-water flowing over the surface; but Mr. Wedderburn suggests as a possible explanation that radiation may proceed at a different rate in the case of the patches of water with the peculiar oily appearance so often observed. Observations on the temperature of water in the neighbourhood of ice were made after a night with a minimum recorded temperature of 22°·5 Fahr. With a general mean temperature of about 37°·5, the temperature at the surface, where the water was open, was 34°, and within a yard of the ice, 32°·8. Below the ice, the temperature gradient in the surface layers was remarkably steep, 37°·4 being reached at 5 feet, while below that depth the temperature was very nearly uniform. This shows how rapid the cooling must have been, and gives an indication of the depth to which radiation from the loch is appreciable. Mr. Wedderburn concludes by quoting from Mcfarlane's 'Geographical Collections' (1726), recently edited by Sir A. Mitchell, statements regarding the non-freezing of lochs, which are in close agreement with present information.

The Weather and Anti-Cyclones in Europe and America.—While the general characteristics of cyclones and anti-cyclones—those great whirling masses of air which revolve in mean and higher latitudes round regions of low and high atmospheric pressure — are a matter of common knowledge, climatologists are divided in opinion—first, generally, as to the conditions of temperature of the two forms of air-movement; and second, specially, as to the relation of the American types to those prevailing in Europe. In the main, the questions at issue centre in the mutual relations of "cold" and "warm" anti-cyclones. In an article entitled 'Die räumliche Verteilung der meteorologischen Elemente in den Antizyklonen,' with eight text illustrations and four plates (*Denkschriften der Mathem.-Naturwissens. Classe der Kaiserl. Akad. d. Wissenschaften*, vol. **24**, Wien, 1908), Dr. Stanislaus Hanzlik, of Prague, sums up the problem in the following propositions: Has Europe, too, anti-cyclones corresponding to the cold American type? and, secondly, are these cold and warm anti-cyclones two different types of anti-cyclones, or are they perhaps but different phases of development of one and the same anti-cyclone? As data for investigation of the question, the observations of mountain observatories—ten European and two American (Mount Washington and Pike's peak)—were made use of, together with observations in the open air, at Kite and other stations. Hanzlik arrived at an answer to these questions by examining how the meteorological elements are distributed within the entire wide space over which, horizontally and

vertically, an anti-cyclonal whirl passes. These elements are: the atmospheric pressure, the deviation of temperature from a fixed mean, the relative humidity, cloudiness, and wind (direction and velocity). The result of the investigation is to show that there is intrinsically no difference between the American and the European anti-cyclones. The origin of these wandering whirls is the same on both continents. Here, as there, they are thermically produced, by cold, heavy masses of air; only the rate at which the development of the whirl proceeds is different in America from what it is in Europe. Here, in consequence of rapid retardation of its velocity of propagation, a cold anti-cyclonal whirl, reaching to comparatively low altitudes, becomes transformed, as a rule, into a warm anti-cyclone, and seldom advances swiftly from west to east as a permanent cold whirl. In North America, on the other hand, to the east of the Rocky mountains, the process usually takes place in a reverse sense.

GENERAL.

The Practical Uses of Ski.—We have received the copy of a memorandum drawn up by Captain C. Hordern, R.E., on the uses and possibilities of ski as a means of locomotion. The writer considers that, popular as ski-running has become as a sport, its advantages from a more practical point of view have not yet been sufficiently recognized, at least in India, to which country his notes primarily apply. They are intended to afford data and suggestions as to the manner and extent of the possible utilization of ski, and in their compilation the writings of mountaineers and others bearing on the question, especially Mr. E. C. Richardson's 'Ski-Running,' have been freely consulted. After pointing out the special advantage possessed by ski in the facilities offered for gliding motion by reducing friction to a minimum, Captain Hordern considers the various conditions of snow unfavourable to their use, and the extent to which these may be circumvented, arriving at the conclusion that "as a general rule, where snow has to be crossed, men should go on ski." He gives some instances, from the actual experience of ski-runners, of the rate of progress possible in various circumstances, and though he is perhaps inclined to underestimate the speed attainable on snow by an ordinarily active man without such aids, he has naturally no difficulty in proving the advantage to be gained from their use, especially as a means of progression downhill. Among the dangers incidental to ski-running, the handbook on the subject above mentioned is quoted as pointing to freshly fallen snow, with its liability to generate avalanches, as quite the most serious. But this and other risks are not peculiar to ski-running, and it is held that the "proper and profitable use of ski, so far from being dangerous, may be taken to be essentially safe." It is in connection with possible military operations in winter on the Indian frontier, that the writer lays special stress on the desirability of studying the question; and he considers both how and by whom ski might profitably be used during such operations. He points out the great extent to which reconnaissance would be facilitated in a snow-clad country by their use, and urges the desirability of training a special corps of ski-runners in the case of Gurkha and other hill regiments, whose men would no doubt take to the art very keenly. Captain Hordern concludes with some practical hints as to the manner of using ski.

The Geographical Lectureship at Glasgow University.—We learn with much satisfaction that Captain H. G. Lyons, R.E., the well-known Director of the Egyptian Surveys, has been appointed to the newly established Lectureship in Geography at Glasgow University. It is matter for congratulation, firstly, that the Court of the University should have shown so enlightened an appreciation of the importance of geography as a University subject as to establish the lectureship, and,

secondly, that it has been fortunate enough to secure the services of so distinguished a geographer as Captain Lyons, who may be relied upon to make the experiment a thorough success. Captain Lyons, who has also received from the Glasgow Provincial Committee the appointment of Lecturer in Geography to teachers in training, will take up his new duties in October of this year.

Mr. Chisholm on the Definition of Geography: A Correction.—Mr. Chisholm writes to point out that in the abstract of his introductory lecture at the University of Edinburgh given in the January number of the *Journal*, there is one statement that is apt to mislead those who have not read the lecture. In the abstract it is stated that "Mr. Chisholm combats the view of Profs. Davis and Penck that biogeography and not anthropogeography ought to be set alongside of physical geography." Now, in the lecture Mr. Chisholm expressly says that "logically, of course, there can be no objection to this view" of the professors named, and it is solely for practical reasons that he proposes to limit himself to anthropogeography. It is true that he goes on to take exception to the ground on which Prof. Davis bases the division into physical geography and biogeography, but he makes no objection to the division in itself.

Association of American Geographers.—The fifth annual meeting of this association was held in Baltimore, December 31, 1908, to January 2, 1909, under the presidency of Mr. G. K. Gilbert. Prof. Albrecht Penck gave a lecture before the association at its opening session on Thursday evening, on "Man, Soil, and Climate." Other features of the meeting were the president's address by Mr. Gilbert, on the subject, "Earthquake Forecasts," and a round-table conference on "Geography for Secondary Schools," conducted by Prof. R. E. Dodge. The conference was held informally in connection with a smoker at the Johns-Hopkins Club on Friday evening. About thirty papers were read by members, representing meteorology and various phases of physiographical, biological, human, and educational geography. The important subject of cartography was also well represented. The officers for the ensuing year are: President, W. M. Davis; first vice-president, L. A. Bauer; second vice-president, E. R. Johnson; secretary, A. P. Brigham; treasurer, N. M. Fenneman; councillors, Cyrus C. Adams, R. S. Tarr, and R. E. Dodge. The place of the next meeting will be fixed by the council.

OBITUARY.

Prof. H. G. Seeley, F.R.S.

Born in London in the year 1839, Prof. Seeley has been for many years a conspicuous figure in the ranks of British geologists, and one who by his wide knowledge and laborious researches, has filled a large part in the progress of the science during the last forty years. He was in his 69th year, yet continued to undertake his duties at King's College, where he was appointed professor of geography in 1876, and of geology and mineralogy in 1896. His special field of work was the investigation of fossil reptiles, and in a long series of important papers he has described the *Anomodontia* of South Africa. In this respect he had no equal, and much of his work can only be judged by specialists. He went to Cambridge in 1859, where he assisted Prof. Sedgwick, who was then in failing health. Besides arranging specimens in the museum, Seeley gave occasional lectures, and amid his other duties, for he was always an arduous worker, found time to publish papers on the fossils then being obtained from the Cambridge

Greensand. His notable discoveries at that time include the earliest British birds. For many years the deceased professor conducted the excursions of the London Geological Field Class. This brought him into contact with a wide circle of scientific people about London, and those who had taken part in his excursions never forgot his geniality and the luminous character and extent of his information on all matters geological. In 1891 he brought out a useful handbook to those excursions. Better known was his great text-book of 'Physical Geology' (1885), a revision of Phillips' work, the stratigraphical portion being done by the late Robert Etheridge. More recently he wrote a popular work on flying reptiles, 'The Dragons of the Air.' He was a Fellow of the Royal Society, and in 1885 the Geological Society of London awarded him the Lyell medal for his researches. He died on January 8, at his residence in London.

J. S. F.

Robert Codrington.

By the death of Mr. Robert Codrington, which occurred in London, as a result of heart disease, on December 16 last, the British South Africa Company loses one of its most valued officials, whose work as an administrator in Northern Rhodesia has been widely known and appreciated. Educated at Marlborough College, Mr. Codrington joined the Bechuanaland border police in 1890, at the age of twenty-one years, and took part in the Matabele campaign of 1893. Two years later he received a post under the South Africa Company in the territory north of the Zambezi, and became deputy administrator of North-Eastern Rhodesia in 1898. In 1900 he became administrator of the same province, a post which he held till 1907, when he was transferred to the same office in North-Western Rhodesia. He had returned to this country on leave of absence in November last, but though then seriously ill, his death was quite unexpected.

During the course of his work in Rhodesia, Mr. Codrington had contributed to geography, both by his own journeys and by the assistance accorded to other travellers. The account of one of his most important journeys, during which some new ground was broken to the south of Lake Bangweulu, was given in the *Journal* for March, 1900. The principal object of this journey was to visit the site of Livingstone's death, and to save from threatened destruction the inscription cut by his native followers. For the zeal and energy with which he carried out the task of securing and bringing home the section of the tree containing the inscription, and for the assistance subsequently given towards the erection of the permanent monument on the spot, Mr. Codrington earned the gratitude of all the friends and admirers of the great traveller. Other papers by him are to be found in the *Journal*, vol. **7**, p. 183; vol. **11**, p. 509; and vol. **19**, p. 598.

Mr. Codrington had been a Fellow of the Society since 1897, and was awarded the Back Memorial in 1900. He was respected by all who knew him, and his loss will be felt severely in the country for which he did so much.

J. W. Brooke.

A tragic end has, we regret to state, befallen this adventurous traveller, who set out some three years ago in the hope of filling up one of the most important gaps in Central Asian geography, by tracing the connection between the Sanpo, of Tibet, and the Brahmaputra. In this he was unsuccessful, but he had accomplished some remarkable pieces of travel in Tibet and Western China. At the time of his death

he was in the country of the Lolos, and the catastrophe seems to have resulted from a fight with these people.

John Weston Brooke was a son of Mr. J. A. Brooke, J.P., of Feney Hall, Almondbury, Huddersfield, and came of a family well known and respected throughout the south of Yorkshire. He was educated at Repton school, on leaving which, at the age of nineteen, he volunteered for service at the front in the South African War. He saw a good deal of fighting, gained a medal with three clasps, and on his return obtained a lieutenancy in the 7th Hussars. In 1902, having had no further chance of active service, he resigned his commission, and soon afterwards went out to British East Africa, where he did some good pioneer work for the East African Syndicate in the north-east of the Uganda Protectorate. The geographical results of this trip, which entailed considerable hardships, were published in the form of a paper and map in the *Journal* for May, 1905. Being ambitious of further distinguishing himself as an explorer, Mr. Brooke did all he could to qualify himself by going through a course of surveying at the Society and by other study. He set out for India in March, 1906, since which date but little has been generally known of his movements, though he reported himself to his family whenever opportunity offered.

Mr. Brooke's first idea was to start from Assam; but this project was vetoed by the Indian Government on account of the risk, and he therefore decided to make an attempt through China. With much determination he organized an expedition to the south from Sining, near Kuku Nor, and this he carried out with only two or three native followers, meeting with various adventures (including a hand-to-hand fight with a Tibetan robber), but succeeding in pushing on across the Tang-la range to within about 200 miles of Lhasa, the obstruction of the authorities then necessitating a return.

After a visit to Japan Mr. Brooke returned to China, this time turning his attention to the mountains of Western Sechuan, inhabited by the so-called Si-fan tribes. At Chengtu he received much help from Mr. Fergusson (whose map and notes were printed in the *Journal* for December last), and the spring and summer of 1908 seem to have been occupied in survey work in the region to the north of Ta-chien-lu, which had been traversed by that missionary the year before.* Early in November Mr. Brooke appears to have set out for India *viâ* the Lolo country, accompanied by Mr. C. H. Mears, who, however, was not with him at the time of the fatal attack, but who sent the news home from Ning-yuan fu.

Mr. Brooke seems to have given some attention to the zoology of the mountains of Sechuan, where, he says, there are various curious animals as interesting as the okapi. Botany, too, was not neglected; and we are informed by Colonel Prain that, after returning from his Sifan journey, he wrote to Kew enclosing specimens of a *Meconopsis*, which he thought might be new. Although this is not precisely the case, it has proved to be a species (*M. quintuplinervia*) which had only once before been met with, and then in Kansu, by Prjevalsky. With a photograph of this plant, he also sent to Kew one showing a group of several species of the same genus, one of which apparently does belong to a very fine form as yet undescribed. It is much to be hoped that a collection of plants which Mr. Brooke intimated his intention of sending to Kew may eventually reach their destination.

Of a simple, unassuming disposition, the deceased traveller never courted publicity, but those acquainted with him knew him to be possessed of true British grit, and his untimely death is much to be deplored.

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* The resulting map has just been received at the Society through Mrs. Brooke, mother of the deceased traveller, and we hope to publish a reduction of it in due course.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1908–1909.

Christmas Lecture, Monday, January 4, 1909.—"The Land of the Vendetta." By the Rev. T. T. Norgate.

Christmas Lecture, Friday, January 8, 1909.—"Zigzag Journeys in Many Lands." By Edward Page Gaston.

Sixth Meeting, January 11, 1909.—Major Leonard Darwin, President, in the Chair.

Elections.—*Thomas Robert Ablett; Brandon Talfourd Brierley; Henry Perot Christian; George Dean; Major Richard Mildmay Foot; F. R. H. Garrett; J. H. Gibbon, R.A.; James Hamilton; Ernest Eric Ferris Horner; Charles Hadley Hopkins; H. T. Humfress; Dr. E. Edward Jones; G. Lloyd; Hon. Sir Arthur Morgan; Rev. Samuel James Norman, M.A.; C. G. Grant Peterkin; The Earl of Stradbroke; Lewis Charles Wallach; Hugh Gordon Watson; George Bransby Williams.*

The paper read was:—

"A Journey across the Sahara from Tripoli to Lake Chad." By Hanns Vischer.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s)
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Carpathians. **Pax.**

Die Vegetation der Erde: Sammlung pflanzengeographischer Monographien, herausgegeben von A. Engler und O. Drude. X. Grundzüge der Pflanzenverbreitung in den Karpathen. Von F. Pax. II. Band. Leipzig: W. Engelmann, 1908. Size 10 × 7, pp. viii. and 322. *Map and Illustrations. Price* 15*s.* 3*d.*

France—Alps. **Briot.**

Les Alpes françaises: Nouvelles études sur l'économie alpestre. Diverses questions générales et monographies. Par F. Briot. Paris: Berger-Levrault et Cie., 1907. Size 10 × 6½, pp. xii. and 324. *Maps and Illustrations. Price* 20 *fr.*

Valuable studies in forestation, pasturage, and other subjects connected with the best methods of utilizing the resources of the mountains.

France—Berry. **Vacher.**

Antoine Vacher. Le Berry: contribution à l'étude géographique d'une région française. Paris: A. Colin, 1908. Size 10 × 6½, pp. 548. *Maps, Diagrams, and Illustrations. Price* 15 *fr. Presented by the Publishers.*

France—Regions. **Gallois.**

L. Gallois. Régions naturelles et noms de pays. Etude sur la région parisienne. Paris: Librarie A. Colin, 1908. Size 9 × 5½, pp. 356. *Facsimile-maps. Price* 8 *fr. Presented by the Publishers.*

Germany—Baltic Coast. **Bartels.**

Die Gestalt der deutschen Ostseeküste. Von Dr. Walther Bartels. (Geographische Arbeiten, herausgegeben von Dr. Willi Ule, 1.) Stuttgart: Strecker & Schröder, 1908. Size 9 × 6, pp. xii. and 128. *Price* 4m. 50. *Presented by the Publishers.*

Germany—Saxony. **Weissbach.**

Forschungen deuts. Landes- u. Volkskunde **17** (1908): 275–416.

Wirtschaftsgeographische Verhältnisse, Ansiedlungen und Bevölkerungsverteilung im mittleren Teile des sächsischen Erzgebirges. Von Dr. Friedrich Weissback. *Maps.*

Greece. **Baedeker.**

Greece: Handbook for travellers. By Karl Baedeker. Fourth edition. Leipzig: K. Baedeker, 1907, [1908]. Size 6½ × 4, pp. cxxvi. and 448. *Maps, Plans, and Illustrations. Price* 8*s. Presented by the Editor.*

Holland—Relief. *Ts. K. Nederland. Aard. Genoots.* **25** (1908): 747–766. **Balen.**

De wind als geologische factor in het Gooi. Door C. L. van Balen. *Illustrations.*

Iceland. *Globus* **94** (1908): 200–204. **Spethmann.**

Inner-Island. Ein Ueberblick von Hans Spethmann. *Sketch-map and Illustrations.*

Italy. *Nineteenth Century* **64** (1908): 215–232. **Sullivan.**

Shakespeare and the waterways of North Italy. By Sir Edward Sullivan. *Sketch-map.*

A vindication of Shakespeare from the charge of ignorance of Italian geography. (See note in the December number, p. 619.)

Italy—Riviera. **Beeby and Reynolds-Ball.**

The Levantine Riviera: a practical guide to all the winter resorts from Genoa to Pisa. By Dr. W. T. Beeby and Eustace Reynolds-Ball. London: Reynolds-Ball's Guides, 1908. Size 7 × 4½, pp. viii. and 212. *Maps and Illustrations. Price* 2*s.* 6*d. Presented by the Publishers.*

Mediterranean.

The Mediterranean Pilot. Vol. 4. Comprising the Archipelago, with the adjacent coasts of Greece and Turkey; including also the island of Crete or Candia. 4th edition. London: J. D. Potter, 1908. Size 9½ × 6, pp. xxiv. and 384. *Index Chart and Illustrations. Presented by the Hydrographic Office, Admiralty. Price* 4*s.* 6*d.*

Norway—Tromsö. **Le Blond.**

Mountaineering in the Land of the Midnight Sun. By Mrs. Aubrey Le Blond. London: T. Fisher Unwin, 1908. Size 9 × 6, pp. xii. and 304. *Sketch-map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

Russia—Wheat. **Rubinow.**

Russia's Wheat Trade. By I. M. Rubinow. (U.S. Department of Agriculture. Bureau of Statistics, Bulletin 65.) Washington, 1908. Size 9 × 6, pp. 78. *Map.*

Southern Europe—Ornithology. **Lodge.**

Bird-hunting through wild Europe. By R. B. Lodge. London: R. Culley, [1908]. Size 8½ × 5½, pp. 334. *Illustrations. Price* 17*s.* 6*d. net. Presented by the Publisher.*

Spain. **Verner.**

My life among the wild birds in Spain. By Colonel Willoughby Verner. London:

J. Bale, Sons, & Danielsson, 1909. Size 9½ × 7, pp. xvi. and 468. *Illustrations. Price* 21*s. net. Presented by the Publishers.*

Spain—Meteorology.

Resumen de las observaciones meteorológicas effectuadas en la peninsula y algunas de sus islas adyacentes durante el año 1906, ordenado y publicado por el Instituto Central Meteorológico. Madrid, 1908. Size 9 × 6, pp. vi. and 166. *Sketch-map. Presented by the Instituto Central Meteorológico.*

Sweden—Norrland. *Ymer* **28** (1908): 113-121. **Nordlander.**

Minnen af heden tro och kult i norrländiska ortnamen. Af John Nordlander. *Map.*

Traces of pagan influence in the place-names of Norrland.

Switzerland. **Walser.**

Landeskunde der Schweiz. Von Dr. Hermann Walser. Leipzig: G. J. Göschen, 1908. Size 6 × 4, pp. 146. *Map and Illustrations. Price* 80 *pfg. Presented by the Publisher.*

A welcome addition to this useful series.

Turkey. **Upward.**

The east end of Europe; the report of an unofficial mission to the European provinces of Turkey on the eve of the revolution. By Allen Upward. London: J. Murray, 1908. Size 9 × 5½, pp. xxiv. and 368. *Map and Illustrations. Price* 12*s. net. Presented by the Publisher.*

United Kingdom—Cambridgeshire. **Fordham.**

Cambridgeshire maps. II. Nineteenth Century cartography of Cambridgeshire. By Herbert George Fordham. (From the *Cambridge Antiquarian Society's Communications*, vol. 12.) Cambridge, 1908. Size 11½ × 9, pp. 151-232 and xii. *Facsimile-maps. Presented by the Author.*

This completes Sir H. Fordham's valuable study of Cambridgeshire maps.

United Kingdom—London. **Ditchfield.**

Memorials of old London. Edited by P. H. Ditchfield. 2 vols. London: Bemrose & Sons, 1908. Size 9 × 6, pp. (vol. 1) xvi. and 240; (vol. 2) viii. and 262. *Facsimile plans and Illustrations. Price* 15*s. net. Presented by the Publishers.*

ASIA.

China—Tientsin. **Brown.**

Religion in Tientsin. By Frederick Brown. Shanghai: Methodist Publishing House, 1908. Size 7½ × 5, pp. viii. and 62. *Illustrations. Presented by the Author.*

Eastern Asia. **Ronaldshay.**

A wandering student in the Far East. By the Earl of Ronaldshay. 2 vols. London, etc.: Wm. Blackwood & Sons, 1908. Size 8½ × 5½, pp. (vol. 1) xviii. and 318; (vol. 2) viii. and 360. *Map and Illustrations. Price* 21*s. net. Presented by the Publishers.*

India. **Hengstenberg.**

Hindustan: Indische Reiseeindrücke. Von Ernst Hengstenberg. Berlin: D. Reimer, 1908. Size 10 × 6½, pp. xii. and 192. *Illustrations. Price* 8*m. Presented by the Publisher.*

India.

The Imperial Gazetteer of India. New edition. Vols. **19-24.** Nāyakanhatti to Zīra. Oxford: Clarendon Press, 1908. Size 8½ × 5½. *Maps. Price* (*per set of* 26 *vols.*) £5. *Presented by the India Office.*

India—Commercial. **Watt.**

The commercial products of India; being an abridgment of 'The Dictionary of the Economic Products of India.' By Sir George Watt. London: J. Murray, 1908. Size 10 × 6½, pp. viii. and 1190. *Price* 16*s. net. Presented by the Secretary of State for India.*

India—Kashmir. **Pirie.**

Kashmir, the land of streams and solitudes. By P. Pirie. London, etc.: J. Lane, 1909 [1908]. Size 10½ × 7½, pp. 272, *Illustrations. Price* 21*s. net. Presented by the Publisher.*

India—Language. **Thimm**

Hindustani self-taught, with English phonetic pronunciation. By Captain C. A.

Thimm. 3rd edit. London: E. Marlborough, 1908. Size 7½ × 5, pp. 112. *Price 2s. 6d. Presented by the Publishers.*

India—Minerals. **Holland.**

Sketch of the mineral resources of India. By T. H. Holland. Calcutta: Geological Survey Office, 1908. Size 11 × 8½, pp. 86 and xii. *Maps. Price 1s. 6d. Presented by the Geological Survey of India.*

Japan. ——

The eighth Financial and Economic Annual of Japan, 1908. The Department of Finance, Tokyo. Government Printing Office. Size 10½ × 7½, pp. vi. and 200. *Map and Diagrams. Presented by the Minister of Finance.*

Japan—Earthquakes. *J. Tōkyō G.S.* **20** (1908): 251–259. **Ōmori.**

On average period of severe earthquakes in Japan. By Fusakichi Ōmori. [In Japanese.]

Japan—Formosa. *J. College Sc. Tōkyō* **25** (1908): Article 19, pp. 260. **Hayata.**

Flora Montana Formosæ: an enumeration of the plants found on Mount Morrison, the Central Chain, and other mountainous regions of Formosa at altitudes of 3000–13,000 feet. By B. Hayata. *Illustrations.*

Includes a discussion of the relationship of the flora with that of other regions.

Japan—Volcano. *J. Tōkyō G.S.* **20** (1908): 325–336, 403–420. **Kōzu.**

The Volcano Ontake. By Shukusuke Kōzu. *Map.* [In Japanese.]

Korea—Trade. ——

Corea. Report for the year 1907 on the trade of Corea. Diplomatic and consular reports, annual series No. 4120. 1908. Size 9½ × 6, pp. 16. *Map. Price 2d.*

The adoption of a standard time for Korea, that of 127° 30′ E., or half an hour later than Tōkyō time, is noted.

Malay Archipelago—Borneo. **Hirschi.**

Ts. K. Nederland Aard. Genoots. **25** (1908): 777–806.

Vorläufiger Bericht über einen geologischen Streifzug in Central Borneo—Oberlauf Moeroeng (Barito). Von Dr. H. Hirschi. *Map and Illustrations.*

Malay Archipelago—Borneo. **Beech.**

The Tidong dialects of Borneo. By Mervyn W. H. Beech. Oxford: Clarendon Press, 1908. Size 7 × 4½, pp. 120. *Illustrations. Price 5s. net. Presented by the Publishers.*

Malay Archipelago—Buru. **Van der Miesen.**

Ts. K. Nederland Aard. Genoots. **25** (1908): 833–871.

Een tocht langs de noordoost kust van Boeroe (January 6–29, 1908). Door J. H. W. van der Miesen. *Maps.*

Malay Archipelago—Krakatau. **Ernst.**

The new flora of the volcanic island of Krakatau. By Dr. A. Ernst. Translated by A. C. Seward. Cambridge: University Press, 1908. Size 10½ × 7, pp. vi. and 74. *Sketch-maps and Illustrations. Price 4s. net. Presented by the Publishers.*

English readers unacquainted with German will welcome this translation of an important paper, in which some additions and corrections have been incorporated. The original was noticed in vol. **32**, p. 428.

Malay States. **Young.**

Federated Malay States. Report on the Trigonometrical and General Survey Department for the year 1906. By A. E. Young. Taiping, 1907. Size 13½ × 8½, pp. 6. *Presented by the Chief Surveyor, Federated Malay States.*

Persia. *B.S. Belge d'Etudes Col.* **15** (1908): 627–672. ——

Renseignements à l'usage des voyageurs et des résidents in Perse. *Map.*

Russia—Caucasus. **Martel.**

E.-A. Martel. La côte d'azur russe (Riviera du Caucase). Voyage en Russie méridionale, au Caucase occidental et en Transcaucasie (Mission du Gouvernement Russe, 1903). Paris: Ch. Delagrave, [1908]. Size 11½ × 8, pp. 358. *Maps and Illustrations. Price 10 fr. Presented by the Publishers.*

Western Asia. **Aubin.**

Eugène Augin. La Perse d'aujourd'hui; Iran; Mesopotamie. Paris: A. Colin, 1908. Size 7½ × 4½. *Map. Price 5 fr. Presented by the Publishers.*

Western Asia. **Grothe.**

Meine Reise durch Vorderasien (Kleinasien, Mesopotamien u. Persien) 1906 und 1907. Vorläufiger Bericht von Dr. Hugo Grothe. ("Der Orient," herausgegeben von Dr. Hugo Grothe. 6. Heft.) Halle-a.-S.: Gebauer-Schwetschke, 1908. Size 9½ × 6½ pp. 84. *Price* 1 *m.* 80. *Presented by the Publishers.*

Western Asia—Ethnology. **Thompson.**

Semitic magic: its origins and development. By R. Campbell Thompson. London: Luzac & Co., 1908. Size 9½ × 6, pp. lxviii. and 286. *Price* 10*s.* 6*d. net. Presented by the Publishers.*

AFRICA.

Abyssinia. *Cairo Sci. J.* **2** (1908): 2–16. **Craig.**

Notes on an expedition to Addis Abbaba. By J. I. Craig.

The route was from Jibuti by railway and caravan. No date seems to be given.

Africa. *Petermanns M.* **54** (1908): 147–160, 182–188. **Passarge.**

Die natürlichen Landschaften Afrikas. Von Prof. Dr. S. Passarge. *Maps.*

British East Africa. **Chapman.**

On Safari: big-game hunting in British East Africa. By Abel Chapman. London: E. Arnold, 1908. Size 9 × 5½, pp. xvi. and 340. *Sketch-maps and Illustrations. Price* 16*s. net. Presented by the Publisher.*

British East Africa. **Churchill.**

My African journey. By the Right Hon. Winston Spencer Churchill. London: Hodder & Stoughton, 1908. Size 7½ × 5, pp. xiv. and 226. *Maps and Illustrations. Price* 5*s. net. Presented by the Publishers.*

Congo. **Baccari.**

E. Baccari. Il Congo. Roma: "Rivista Marittima," 1908. Size 12 × 8½, pp. xxiv. and 770. *Maps and Illustrations. Presented by the Societa Geografica Italiana.*

The author went out in 1903–04 on behalf of the Italian Government to study the opportunities offered by the eastern parts of the state for colonization by Italians. This book gives an account of the mission, interspersed with much general information on the Congo territories.

East and South Africa. **Kirkland.**

Some African highways: A journey of two American women to Uganda and the Transvaal. By Caroline Kirkland. London: Duckworth & Co., [1908]. Size 8½ × 5½, pp. xvi. and 346. *Map and Illustrations. Price* 6*s. net. Presented by the Publishers.*

Egypt—Cotton. **Roux.**

François Charles Roux. La production du coton en Egypte. Paris: A. Colin, 1908. Size 11 × 7, pp. viii. and 410. *Price* 7 *fr.* 50. *Presented by the Publisher.*

A careful study of the question of cotton production in Egypt.

French Congo. *Tour du monde* **14** (1908): 385–480. **Lenfant.**

La découverte des sources du Centre africain. Par le Commandant Lenfant. *Sketch-map and Illustrations.*

A popular account of Commandant Lenfant's last expedition (cf. *Journal*, vol. **30**, p. 440; **31**, p. 106).

French Congo. *B.S.G. Alger* **13** (1908): 222–235. **Pouperon.**

Deuxième mission de P. Pouperon dans la Sangha (Août-Septembre 1907). Par P. Pouperon.

German East Africa—Ethnology. **Weule.**

Wissenschaftliche Ergebnisse meiner ethnographischen Forschungsreise in den Südösten Deutsch-Ostafrikas. Von Dr. Karl Weule. (Ergänzungsheft Nr. 1 der Mitteilungen aus den Deutschen Schutzgebieten.) Berlin: E. S. Mittler und Sohn, 1908. Size 13 × 9½, pp. x. and 150. *Map and Illustrations.*

German East Africa—Language. **Struck.**

A vocabulary of the Fipa language. By Bernard Struck. (Supplement to the Journal of the African Society, October, 1908.) Size 8½ × 6, pp. xii.

Gold Coast. *Z. Kolonialpolitik* **10** (1908): 584–589. **Giezendanner.**

Das Gambaga-Land. Von F. Giezendanner. *Sketch-map.*

Kamerun—Ethnology. **Mansfeld.**

Urwald-Dokumente: vier Jahre unter den Crossflussnegern Kameruns. Von Dr. Alfred Mansfeld. Berlin: D. Reimer, 1908. Size 11 × 7½, pp. xvi. and 310. *Maps and Illustrations. Price* 12*m. Presented by the Publisher.*

Mauritius—Malaria. **Ross.**

Report on the prevention of malaria in Mauritius. By Ronald Ross. London: J. & A. Churchill (1908). Size 10 × 7, pp. xvi. and 186. *Plan and Illustrations. Price* 5*s. net. Presented by the Publishers.*

North-West Africa. **Lorin.**

Henri Lorin. L'Afrique du Nord: Tunisie, Algérie, Maroc. Paris: A. Colin, 1908. Size 7½ × 5, pp. ii. and 418. *Sketch-maps and Illustrations. Price* 3 *fr. Presented by the Publisher.*

Rhodesia—Languages. **Madan.**

Lenje handbook: a short introduction to the Lenje dialect spoken in North-West Rhodesia. By A. C. Madan. (Pp. 154.) Lala-Lamba handbook: a short introduction to the south-western division of the Wisa-Lala dialect of Northern Rhodesia, with stories and vocabulary. By the same. (Pp. 142). Oxford: Clarendon Press, 1908. Size 7 × 4½. *Price* 3*s.* 6*d. net each. Presented by the Publishers.*

Sierra Leone—Language. **Migeod.**

The Mende language. By F. W. H. Migeod. London: K. Paul & Co., 1908. Size 7½ × 5, pp. 272. *Price* 7*s.* 6*d. net. Presented by the Publishers.*

Consists of four parts, viz. useful phrases, grammar, vocabularies, and stories.

South Africa. **Brown.**

The guide to South Africa . . . edited annually by A. Samler Brown and G. Gordon Brown. 1908–09 (sixteenth) edition. London: S. Low & Co., [1908]. Size 7½ × 5, pp. xlii. and 478. *Maps, Plans, and Diagrams. Price* 2*s.* 6*d. Presented by the Publishers.*

Uganda—Ruwenzori. **Filippi and Abruzzi.**

Ruwenzori. An account of the expedition of H.R.H. Prince Luigi Amedeo of Savoy, Duke of the Abruzzi. By Filippo de Filippi. London: A. Constable & Co., 1908. Size 10½ × 7, pp. xvi. and 408. *Maps and Illustrations. Price* 31*s.* 6*d. net. Presented by the Publishers.*

See review in the January number, p. 75.

NORTH AMERICA.

Alaska. *U.S. Geol. Surv. B.* **335** (1908): pp. 142. **Martin.**

Geology and Mineral resources of the Controller Bay Region, Alaska. By G. C. Martin. *Maps and Illustrations.*

Canada—Historical. **Hendry and Burpee.**

P. and T.R.S. Canada, Ser. III. 1 (1907): Sect. 2, 307–364.

York factory to the Blackfeet. The journal of Anthony Hendry, 1754–55. Edited by Lawrence J. Burpee. *Maps and Illustrations.*

Canada—Historical. **Bradley.**

The making of Canada. By A. G. Bradley. London: A. Constable & Co., 1908. Size 9 × 6, pp. viii. and 396. *Sketch-maps. Price* 12*s.* 6*d. net. Presented by the Publishers.*

Canada—Quebec. **Rouillard.**

Eugène Rouillard. La côte nord du Saint-Laurent et le Labrador Canadien. Quebec: Laflamme et Proulx, 1908. Size 9½ × 6¼, pp. 188. *Map and Illustrations. Price* 4*s.* 6*d.*

A systematic topography of a little-known part of Eastern Canada.

Canada—Quebec. *P. and T.R.S. Canada*, Ser. III. 1 (1907): Sect. 4, 157–183. **Laflamme.**

Les tremblements de terre de la région de Quebec. Par J.-C. K. Laflamme. *Sketch-map.*

Canada and Newfoundland. **Howley.**

P. and T.R.S. Canada, Ser. III. 1 (1907): Sect. 2, 291–305

The Labrador boundary question. By Archbishop Howley. *Sketch-map.*

Labrador. **Townsend.**

Along the Labrador coast. By Charles Wendell Townsend. London: T. Fisher Unwin, 1908. Size 8½ × 5½, pp. 290. *Map and Illustrations. Price 5s. net. Presented by the Publisher.*

Mexico—Deserts. **Hornaday.**

Camp-fires on desert and lava. By William T. Hornaday. London: T. Werner Laurie, [1908]. Size 9½ × 6, pp. xx. and 366. *Sketch-maps and Illustrations. Price 16s. net. Presented by the Publisher.*

Newfoundland. **MacGregor.**

Newfoundland. Report by the Governor on a visit to the Micmac Indians at Bay D'Espoir. By Sir William Macgregor. Colonial Reports, Miscellaneous, No. 54, 1908. Size 9½ × 6, pp. 10. *Plans. Price 2s.*

United States. **Fischer.**

Sammlung Göschen. Landeskunde der Vereinigten Staaten von Nordamerika. Von Prof. Heinrich Fischer. Two vols. Leipzig: G. J. Göschen, 1908. Size 6½ × 4, pp. (vol. 1) 116; (vol. 2) 104. *Maps and Illustrations. Price (each) 80 Pfg. Presented by the Publishers.*

A concise but instructive sketch of the geography of the United States.

United States—Colorado. *U.S. Geol. Surv. B.* **350** (1908): pp. 62. **Gale.**

Geology of the Rangely Oil District, Rio Blanco county, Colorado. With a section on the water survey. By Hoyt S. Gale. *Maps and Sections.*

United States—Idaho. **Ransome and Calkins.**

U.S. Geol. Surv., Prof. Paper **62** (1908): pp. 204.

The geology and ore deposits of the Cœur d'Alene district, Idaho. By Frederick Leslie Ransome and Frank Cathcart Calkins. *Maps, Plans, and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Argentine—Archæology. **Ambrosetti.**

Exploraciones arqueológicas en la ciudad prehistórica de "La Paya" (Valle Calchaqui: Provincia de Salta). Campañas de 1906 y 1907. Por Juan B. Ambrosetti. Buenos Ayres, 1908. Size 11 × 7½, pp. 534. *Sketch-maps and Illustrations. Presented by Sir C. R. Markham.*

Argentine and Paraguay. **Hernández.**

Colección de libros y documentos referentes á la historia de América. Tomo vii. El extrañamiento de los Jesuítas del Rio de la Plata y de las Misiones del Paraguay, por Decreto de Carlos III. Estudio del Pablo Hernández. Madrid: V. Suárez, 1908. Size 8 × 5, pp. 422. *Purchased.*

Brazil—São Paulo. **Casabona.**

Louis Casabona. São Paulo du Brésil: Notes d'un colon français. Paris: E. Guilmoto, 1908. Size 7½ × 5½, pp. iv. and 232. *Illustrations. Price 3 fr. Presented by the Publisher.*

British Guiana—Geology. **Harrison.**

Geology of the goldfields of British Guiana. By J. B. Harrison; with historical, geographical, and other chapters by Frank Fowler and C. Wildgress Anderson; and with an Appendix giving the laws and regulations governing the mining industry. London: Dulau & Co., 1908. Size 8½ × 5½, pp. x. and 320. *Illustrations. Price 5s. net. Presented by the Publishers.*

Largely concerned with petrography, but likely to be useful, incidentally, to the geographer.

Central America—Historical.

Relaciones históricas y geográficas de América Central. (Colección de libros y documentos referentes á la historia de América, tomo viii.) Madrid: V. Suárez, 1908. Size 8 × 5, pp. lxxx. and 510. *Purchased.*

Costa Rica.

República de Costa Rica: América Central. Memoria de Relaciones Exteriores, Justicia, Gracia, Culto y Beneficencia, presentada al Congreso Constitucional por . . . Luis Anderson, 1908. [San José], 1908. Size 11½ × 8, pp. xxii. and 160.

Dutch Guiana. *Ts. K. Nederland. Aard. Genoots.* **25** (1908): 943-1169. **Goeje.**

Verslag der Toemoekhoemak-Expeditie (Tumuc-Humac-Expeditie). Door C. H. de Goeje. *Map and Illustrations.*

See note in the Monthly Record, December, 1908, p. 623.

Panama—Geology. *American J. Sci.* **26** (1908) : 212–237. **Howe.**

The Geology of the Isthmus of Panama. By Ernest Howe.

Panama and Cuba—Hygiène. **Macpherson.**

Some practical points in the prevention of disease in Panama and Cuba. By Lieut.-Colonel W. G. Macpherson. (Reprinted from *Journal of the Royal Army Medical Corps*, September 1, 1908.) London: John Bale, Sons, & Danielsson, 1908. Size 10 × 7, pp. 22. *Illustrations. Presented by the Author.*

Peru. **Guinness.**

Peru: its story, people, and religion. By Geraldine Guinness. London: Morgan & Scott, 1909 [1908]. Size 9 × 5½, pp. xxiv. and 438. *Maps and Illustrations. Price* 7*s.* 6*d. net. Presented by Dr. H. Grattan Guinness.*

Peru—Irrigation. *B. Cuerpo Ingen. Minas Peru*, No. **56** (1908): pp. 34. **Sutton.**

El problema de la irrigacion del valle de Ica. Por Carlos W. Sutton. *Maps and Diagrams.*

Peru—Loreto. **Larrabure i Correa.**

Colleccion de leyes, decretos, resoluciones i otros documentos oficiales referentes al Departamento de Loreto, formada . . . por el Dr. Carlos Larrabure i Correa. Edicion oficial. Tomo ix. Lima, 1907. Size 9½ × 6½, pp. xxii. and 586. *Presented by the Compiler.*

Contains a good deal of information on the missions and means of communication of this region.

Peru—Loreto. **Larrabure i Correa.**

Coleccion de leyes, decretos, resoluciones i otros documentos oficiales referentes al Departamento de Loreto, formada de orden suprema por el doctor Carlos Larraburi i Correa. Vols. 13–14. Lima, 1907. Size 9½ × 6½, pp. (vol. **13**) xi. and 548; (vol. **14**) xii. and 636.

Vol. **13** contains the final instalment of papers on exploration, and a section on immigration and colonization. The first part of vol. **14** treats of the rubber industry, public works, etc., the rest being a collection of monographs of various dates, some dealing with geographical and historical subjects.

South America. **Bayern.**

Reisestudien aus dem westlichen Südamerika. Von Therese Prinzessin von Bayern. 2 vols. Berlin: D. Reimer, 1908. Size 10 × 7, pp. (vol. **1**) xviii. and 380; (vol. **2**) xiv. and 340. *Maps and Illustrations. Price* 20*m. Presented by the Publisher.*

The main objects of the journey here described—the third American journey undertaken by this indefatigable traveller—were studies of the geography of plants and animals in divers parts of South America. All the States from Venezuela to Chile and Argentina were visited.

South America. **Spruce and Wallace.**

Notes of a botanist on the Amazon and Andes; being records of travel on the Amazon and its tributaries, the Trombetas, Rio Negro, Uaupés, Casiquiari, Pacimoni, Huallaga, and Pastasa; as also to the cataracts of the Orinoco, along the eastern side of the Andes of Peru and Ecuador, and the shores of the Pacific, during the years 1849–1864. By Richard Spruce, PH.D. Edited and condensed by Alfred Russel Wallace. 2 vols. London: Macmillan & Co., 1908. Size 9 × 5½, pp. (vol. **1**) lii. and 518; (vol. **2**) xii. and 542. *Portrait, Maps, and Illustrations. Price* 21*s. net. Presented by the Editor.*

West Indies. **Ober.**

A guide to the West Indies and Bermudas. By Frederick A. Ober. London: T. Fisher Unwin, 1908. Size 7 × 4½, pp. x. and 526. *Maps and Illustrations. Price* 8*s.* 6*d. net.*

AUSTRALASIA AND PACIFIC ISLANDS.

Fiji. **Thomson.**

The Fijians: a study of the decay of custom. By Basil Thomson. London: W. Heinemann, 1908. Size 8½ × 6, pp. xx. and 396. *Illustrations. Price* 10*s. net. Presented by the Publisher.*

See review, *ante*, p. 203.

New South Wales—Fish. **Stead.**

Department of Fisheries, New South Wales. The edible fishes of New South

Wales: their present importance and their potentialities. By David G. Stead. (Sydney), 1908. Size 8¼ × 5¼, pp. 124. *Map and Illustrations. Presented by the Department of Fisheries, N.S.W.*

New Zealand—Survey. **Humphries.**

New Zealand. Report on the Survey Operations of the Department of Lands for the year 1907-8. By Thomas Humphries. Wellington, 1908. Size 13½ × 8, pp. 38. *Maps and Sections. Presented by the Secretary of State for the Colonies.*

Includes a brief account of the magnetic observations at the Auckland and Campbell groups (cf. September number, p. 310), as well as a report on the magnetic work in the main islands.

New Zealand—Tasman Bay. **Smith.**

Captain Dumont d'Urville's exploration of Tasman Bay in 1827. By S. Percy Smith. (From *Transactions of the New Zealand Institute*, vol. **40**, 1907.) Wellington: John Mackay, 1908. Size 8½ × 5½, pp. 416–447. *Presented by the Translator.*

Translation of passages from the voyage of the *Astrolabe*, with a few explanatory notes.

Pacific. *National G. Mag.* **19** (1908): 546-563. **Blackman.**

The Pacific: the Most Explored and Least Known Region of the Globe. By Leopold G. Blackman. *Sketch-map and Illustrations.*

An account of the proposed research work of the "Pacific Scientific Institution" of Honolulu (cf. *Journal*, vol. **31**, p. 339).

Tasmania—Ben Lomond Plateau. **Legge.**

An investigation into the physiography of the Ben Lomond Plateau, Tasmania. By Colonel W. V. Legge. (Read at the Adelaide Meeting of the Australasian Association for the Advancement of Science, held January, 1907.) Size 8½ × 5½, pp. 6. *Illustration. Presented by the Author.*

A prefatory note gives additional details respecting a visit to the Ben Lomond range in March, 1907 (cf. *Journal* for January, 1908, p. 109, and December, p. 624).

POLAR REGIONS.

Antarctic—Botany. **Cardot.**

Wissenschaftliche Ergebnisse der Schwedischen Südpolar-Expedition, 1901–1903, unter Leitung von Dr. Otto Nordenskjöld. Band iv., Lieferung 8. La flore bryologique des Terres magellaniques, de la Géorgie du Sud, et de l'Antarctide. Par Jules Cardot. Stockholm, 1908. Size 10½ × 8½, pp. 298. *Illustrations.*

Antarctic—Heard Island. **Drygalski.**

Deutsche Südpolar Expedition, 1901–1903 . . . herausgegeben von Erich von Drygalski. II. Band. Geographie, Geologie; Heft 3 (Heard-Insel). Berlin; G. Reimer, 1908. Size 13 × 10½, pp. 223–298. *Illustrations.*

MATHEMATICAL GEOGRAPHY.

Altitude. **Dowson.**

Egypt: Survey Department. The determination of altitudes by levelling. By E. M. Dowson. Cairo, 1908. Size 10½ × 7, pp. 24. *Diagrams.*

Cartography. *G.Z.* **14** (1908): 297-312. **Peucker.**

Neue Bemerkungen zur Theorie und Geschichte des Kartenbildes. Von Karl Peucker.

Charts. **Putnam.**

Nautical charts. By G. R. Putnam. New York: J. Wiley & Sons (London: Chapman & Hall), 1908. Size 9 × 6, pp. viii. and 162. *Charts and Illustrations. Price* $2 (8*s.* 6*d. net*). *Presented by the Publishers.*

A concise outline of the whole subject of chart-making and using, including a few notes on their history.

Determination of Position. **Albrecht.**

Formeln und Tafeln für geographische Ortsbestimmungen. Von Prof. Dr. Th. Albrecht. Vierte Auflage. Leipzig: W. Engelmann, 1908. Size 11 × 8, pp. viii. and 348. *Price* 20*m. Presented by the Publisher.*

Geodesy. **Bakhuyzen.**

Comptes rendus des séances de la Quinzième Conférence Générale de l'Association

Géodésique Internationale réunie à Budapest le 20 au 28 Septembre 1906. Rédigés par le Secrétaire perpétuel H. G. Van de Sande Bakhuyzen. IIe volume. Rapports spéciaux et Rapports sur les travaux du Bureau central in 1904, 1905, 1906 et 1907. Berlin: G. Reimer, 1908. Size 12 × 9, pp. 310. *Maps, Illustrations, and Diagrams.*

See note in vol. **28**, p. 640.

Surveying. **Lovell.**

The plane-table and its use in surveying. By W. H. Lovell. New York: McGraw Publishing Co. (London: E. & F. N. Spon), 1908. Size 7½ × 5, pp. iv. and 50. *Illustrations and Diagrams. Price 4s. 6d. net. Presented by the Publishers.*

Surveying. **Park.**

A text-book of theodolite surveying and levelling, for the use of students in land and mine surveying. By James Park. London: C. Griffin & Co., 1908. Size 8 × 5, pp. x. and 216. *Diagrams and Illustrations. Price 6s. net. Presented by the Publishers.*

Time. **Wade and Craig.**

The determination of local time in sub-tropical latitudes. By E. B. H. Wade and J. I. Craig. (Reprinted from the *Cairo Scientific Journal*, vol. **2**, No. 21, June, 1908.) Cairo, 1908. Size 10½ × 7, pp. 18.

Describes the method by equal altitudes of stars.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Earth-History. **Walther.**

Geschichte der Erde und des Lebens. Von Johannes Walther. Leipzig: Veit und Co., 1908. Size 10 × 7, pp. iv. and 572. *Illustrations. Price 14m. Presented by the Publishers.*

Geology. **Haug.**

Emile Haug. Traité de géologie. Tome II. Les périodes géologiques. Fascicule I. Paris: Libr. A. Colin (1908). Size 10 × 6½, pp. 537–928. *Sketch-maps, Sections, and Illustrations. Price 9 fr. Presented by the Publishers.*

The first volume was reviewed in vol. **31**, p. 668.

Geophysics. **Houston.**

Volcanoes and earthquakes. By Dr. Edwin J. Houston. London: W. & R. Chambers, 1908. Size 7½ × 5, pp. (x.) and 370. *Maps and Illustrations. Price 3s. 6d. Presented by the Publishers.*

A simple account of seismic and volcanic phenomena, suitable for the general reader.

Geophysics. *Beiträge Geophysik* **9** (1908): 378–403. **Von dem Borne.**

Die physikalischen Grundlagen der tektonischen Theorien. Von Georg von dem Borne.

Glacial Epoch. **Wheeler**

The zonal-belt hypothesis: A new explanation of the cause of the Ice Ages. By Joseph T. Wheeler. Philadelphia and London: J. B. Lippincott Co., 1908. Size 8½ × 5½, pp. 402. *Presented by the Author.*

Glaciers. *Le Globe, Mém. S.G. Genève* **47** (1908): 33–42. **Chaix-Dubois.**

Quelques documents nouveau sur les glaciers. Par Émile Chaix-Dubois. *Illustrations.*

Meteorology. **Houston.**

The Atmosphere. By Dr. Edwin J. Houston. London: W. & R. Chambers, 1908. Size 7½ × 5, pp. (viii.) and 326. *Diagrams and Illustrations. Price 3s. 6d. Presented by the Publishers.*

A popular account of meteorological phenomena.

Meteorology—Text-book. **Amengual**

Manual de Meteorología práctica. Compilado por R. Amengual. Valparaiso, 1907. Size 8½ × 5½, pp. xii., 666, 10, and 8. *Maps, diagrams, and illustrations. Presented by the Author.*

Oceanography—Text-book. **Amengual.**

Marina de Chile. Lijeros Apuntes sobre oceanografía, confeccionados por Capitán R. Amengual. Valparaiso, 1908. Size 10 × 6½, pp. xiv., 414, and 14. *Charts, diagrams, and illustrations. Presented by the Author.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Richthofen and Schlüter.**

Ferdinand v. Richthofen's Vorlesungen über Allgemeine Siedlungs- und Verkehrsgeographie. Bearbeitet und herausgegeben von Dr. Otto Schlüter. Berlin: D. Reimer, 1908. Size 9½ × 6½, pp. 16 and 352. *Sketch-maps and Illustrations. Price* 10m. *Presented by the Publishers.*

Commercial. **Eckert.**

Leitfaden der Handelsgeographie (Wirtschafts- und Verkehrsgeographie) mit besonderer Berücksichtigung Deutschlands. Von Prof. Dr. Max Ekert. Zweite Auflage. Leipzig: G. J. Göschen. 1908. Size 8½ × 5½, pp. 300. *Maps and Diagrams. Price* 3.60m. *Presented by the Publishers.*

The first edition was noticed in Vol. **27**, p. 216. The chief addition now made is that of numerous text-diagrams.

Historical—Behaim. **Ravenstein.**

Martin Behaim, his life and his globe. By E. G. Ravenstein. London: G. Philip & Son, 1908. Size 15½ × 12½, pp. viii. and 124. *Facsimile, Maps, and Illustrations. Price* 42*s.* (*After February* 28, 63*s.*) *Presented by the Author.*

This important work will receive special notice.

Historical—Cabeza de Vaca. ———

Colección de libros y documentos referentes á la historia de América, tomo v. y vi. Relación de los naufragios y comentarios de Alvar Nuñez Cabeza de Vaca, Adelantado y Gobernador del Rio de la Plata. 2 vols. Madrid: V. Suárez, 1906. Size 8 × 5, pp. (vol. **1**) xxx. and 390; (vol. **2**) xii. and 430. *Purchased.*

Language. **Mann.**

Esperanto self-taught, with phonetic pronunciation. By William W. Mann. London: E. Marlborough & Co., 1908. Size 7½ × 4½, pp. 128. *Price* 2*s.* 6*d. Presented by the Publishers.*

BIOGRAPHY.

Colquhoun. **Colquhoun.**

Dan to Beersheba: work and travel in four continents. By Archibald R. Colquhoun. London: W. Heinemann, 1909. Size 9 × 6, pp. xviii. and 348. *Portrait. Price* 8*s.* 6*d. net. Presented by the Publisher.*

Galton. **Galton.**

Memories of my life. By Francis Galton. London: Methuen & Co., 1908. Size 9 × 5½, pp. viii. and 340. *Portraits and Sketch-maps. Presented by the Author.*

See review, *ante*, p. 205.

Harrison. **Harrison.**

Recollections of a life in the British Army during the latter half of the nineteenth century. By General Sir Richard Harrison. London: Smith, Elder & Co., 1908. Size 8½ × 5½, pp. x. and 382. *Portrait and Illustrations. Presented by the Author.*

Loch. **Bradshaw.**

Catharine Grace Loch. Royal Red Cross Senior Lady Superintendent Queen Alexandra's Military Nursing Service for India. A Memoir. (Edited by Major-General A. F. Bradshaw.) London: H. Frowde, 1905. Size 7½ × 5, pp. xvi. and 360. *Portraits. Presented by the Editor.*

A good deal of the book consists of notes of travel in various parts of India.

GENERAL.

Education. **Lampe.**

Zur Einführung in den erdkundlichen Unterricht an mittleren und höheren Schulen. Anregungen und Winke von Dr. Felix Lampe. Halle-a.-S.: Buchhandlung des Waisenhauses, 1908. Size 9 × 6, pp. 226. *Price* 3m. *Presented by the Publishers.*

Education—Text-book. **Fairgrieve.**

The round world: an elementary geography. By J. Fairgrieve. London: A. & C. Black, 1908. Size 7 × 4½, pp. x. and 114. *Sketch-maps and Illustration. Price* 1*s.* 4*d. Presented by the Publishers.*

An instructive study of the globe as a whole. The method seems good, but the somewhat excessive generalization may sometimes lead to misapprehension. The use

of temperature maps reduced to sea-level is of doubtful advantage, especially in the case of Africa.

Education—Text-books. **Reynolds.**

Regional geography: the British Isles. By J. B. Reynolds. (Pp. 128.) Europe and the Mediterranean region. By the same. (Pp. 128.) The Americas. By the same. (Pp. 128.) London: A. & C. Black, 1907–8. Size 8½ × 5½. *Maps and Illustrations. Price 2s. each. Presented by the Publishers.*

These little text-books, by an experienced teacher, should prove of great use for the junior classes in schools.

Education—Text-book. **Unstead.**

The Oxford Geographies. Practical geography; Part I. By J. F. Unstead. Oxford: Clarendon Press, 1908. Size 7¼ × 5, pp. 120. *Maps, Plans, and Diagrams. Price 1s. 6d. Presented by the Publishers.*

Hygiene. **Brooke.**

Essentials of sanitary science. By Gilbert E. Brooke. London: H. Kimpton, 1909 [1908]. Size 7½ × 5, pp. xii. and 414. *Diagrams and Illustrations. Price 6s. net. Presented by the Publisher.*

This supplies a great deal of information in handy form, and should be useful to travellers and settlers in new countries.

Miscellaneous Essays. **Baker.**

Literary and biographical studies. By James Baker. London: Chapman & Hall, 1908. Size 9 × 5¾, pp. vi. and 260. *Presented by the Author.*

One of the essays treats of Shakespeare's knowledge of the foreign scenes he depicts.

Photography. **Wellcome.**

Wellcome's Photographic Exposure Record and Diary: Northern Hemisphere, 1909. London, etc.: Burroughs, Wellcome & Co., [1908]. Size 5½ × 3¾, pp. 270. *Illustrations. Price 1s. Presented by the Publishers.*

NEW MAPS.

By **E. A. REEVES**, *Map Curator*, R.G.S.

EUROPE.

Austria-Hungary. **Artaria.**

Artaria's Eisenbahnkarte von Oesterreich-Ungarn mit Stationsverzeichnis, 1909. Vierte Neubearbeitung, ix. Auflage. Vienna: Artaria & Co., 1909. *Price 2.40 kr. Presented by the Publishers.*

Balkan Peninsula. **Johnston.**

Map to illustrate the Near Eastern Question. Scale 1: 2,533,000 or 1 inch to 40 stat. miles. Edinburgh: W. & A. K. Johnston, Ltd., [1908]. *Presented by the Publishers.*

This is a small general map of the Balkan Peninsula, with boundaries clearly shown in colours, according to the different treaties from the year 1861 to the present date. Two small inset maps of Europe are given showing the boundaries as they were in 1815 and 1875. A plan of the Bosporus and Constantinople is also added.

British Isles—England. **Dickinson and Andrews.**

The "Diagram" Series of Hand maps, designed by B. B. Dickinson, F.R.G.S., and A. W. Andrews, F.R.G.S. The Tyne Gap. Scale 1: 520,000 or 1 inch to 8·2 stat. miles. North England. Scale 1: 1,450,000 or 1 inch to 23 stat. miles. New Malden: The Diagram Co., [1908]. *Presented by the Publishers.*

British Isles—England and Wales. **Philip.**

Philips' Handy Administrative Atlas of England and Wales, a series of detailed county maps showing Local Government and Parliamentary Divisions. Edited by George Philip, F.R.G.S. London: George Philip & Son, Ltd., [1908]. *Price 4s. net. Presented by the Publishers.*

This little atlas is intended to show on a series of county maps, in a complete and convenient form, the administrative divisions of England and Wales as they exist at the present time for all purposes of local government and parliamentary representation.

This is done by a series of colour-tinting and bold lines, which serve the purpose well enough, although the latter, showing parliamentary divisions, obliterate the place-names somewhat unnecessarily. The atlas should prove useful to members of parliament, county councillors, and municipal administrators. An alphabetical list of the administrative divisions and a good index to names of places are added.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from December 1 to 31, 1908.

4 miles to 1 inch:—

Revised (second edition). In outline (1 and 2). 1*s.* 6*d.* (engraved).

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1 : 2500 Scale—County Maps:—

Glamorgan (Second Revision), IV. 13. **Hampshire** (Second Revision), LXVII. 15, 16; LXXIII. 15; LXXIV. 15; LXXVI. 2, 3, 15; LXXVIII. 5; LXXXI. 2; LXXXII. 3; LXXXIV. 3, 7, 11, (16 and 15). 3*s. each.* LXVIII. 16. 1*s.* 6*d.* **Kent** (Second Revision), IX. 14, 16; X. 8; XI. 5, 6, 9, 10; XVII. 12, 16; XVIII. 16; XX. 13; XXX. 4; XXXI. 2, 3, 6, 8, 10, 11, 12; XXXII. 1; XL. 4, 12, 14, 16; XLI. 3, 4, 6, 7, 8, 12, 14, 15, 16; XLII. 1; XLIX. 7, 8, 10; L. 2, 7, 8, 10, 11, 12; LI. 1, 5, 10, 11; LXIX. 8; LXX. 13. 3*s. each.* LIX. 5, 10. 1*s.* 6*d.* **Lancashire** (First Revision of 1891 Survey), LXXXVI. 1, 6, 8; XCIII. 7, 8, 10; XCIV. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; CV. 13, 14; CVI. 2, 6, 10, 14; CXII. 1; CXIII. 2, 6. **Yorkshire** (First Revision of 1891 Survey), CLXIV. 3; CLXV. 6, 7, 8, 9, 10, 14, 15; CLXVI. 9, 11; CLXXXIII. 1; CLXXXVI. 7, 9, 13, 15; CLXXXVII. 7, 8, 9, 10, 11, 12; CLXXXVIII. 8, 13, 16; CCI. 1, 6; CCII. 1.

(*E. Stanford, London Agent.*)

British Isles—England and Wales. **Geological Survey.**

4 miles to 1 inch.

New series, printed in colours. Drift Edition. Sheet 18, Bristol Cardiff, etc. *Price* 2*s.* 6*d.*

6-inch Maps—Uncoloured.

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(*E. Stanford, London Agent.*)

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1 : 100,000 or 1·3 inch to 1 stat. mile. Sheets: xxxiii.–15 Toul; xxxiv.–14, Nomeny; xxxiv.–15, Nancy; xxxv.–15, Parroy. Paris: Service Géographique de l'Armée, 1907-08. *Price* 1.60 *fr. each sheet.*

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: vi.–14, St. Brieuc; x.–18, Segré; xi.–11, Douvres-le-Délivrande; xii.–15, Alençon; xvi.–8, Abbeville(est); xvi.–37, Lave-

lanet; xvii.-38, Prades; xviii.-11, Soissons; xviii.-24, Grannat; xviii.-25, Clermont-Ferrand; xix.-26, Ambert; xxiii.-34, Aix; xxvi.-35, Cap Roux; xxvii.-34, Monaco; xxix.-41, Ajaccio. Paris: Ministère de l'Intérieur, Service Vicinal, 1908. *Price 0·80 fr. each sheet.*

ASIA.

Ceylon. **Surveyor-General, Colombo**

Agricultural map of Northern Province, Ceylon. Scale 1 : 253,440 or 1 inch to 4 stat. miles. Colombo: Survey Department, 1908. *Presented by the Surveyor-General of Ceylon.*

This is a general map of the Northern Province of Ceylon, without hills, printed in various colours and symbols showing plantations (coconut, palmyra, etc.), paddy-fields, grass lands, wastes, jungle, and scrub, as well as forest-covered land. Roads, tracks, railways, telegraph lines, and other useful information is given.

India—Goa. **Commissão de Cartographia, Lisbon.**

Carta do Territorio Portuguez de Goa. Scale 1 : 125,000 or 1 inch to 1·9 stat. mile. Lisbon: Commissão de Cartographia, 1905.

A coloured map with hill work roughly shown by vertical hachuring in brown. Plans of Barra de Chaporá, Barra de Betul, Enseada da Agoada, and Barra de Tiragol are given as insets on enlarged scales.

AFRICA.

Morocco. **Larras.**

Carte de reconnaissance du Maroc levées et dessinées par le Capitaine N. Larras 1898-1906. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet: Tanger. Paris: Henry Barrère, [1909].

South Africa. **"South Africa."**

The railway map of South Africa. Scale 1 : 4,000,000 or 1 inch to 63·1 stat. miles. London: Offices of *South Africa*, 1908.

This railway map, which has been revised to date, is issued as a supplement to the number of *South Africa* for December 5, 1908.

Transvaal. **Transvaal Mines Department.**

Transvaal Geological Survey. Scale 1 : 150,000 or 1 inch to 2·36 stat. miles. Sheet 4, Rustenburg. With explanation by W. A. Humphrey, B.A., PH.D. Pretoria: Transvaal Mines Department, Geological Survey, 1908. *Price 2s. 6d. Presented by the Director, Transvaal Geological Survey.*

This sheet extends about 55 miles east and west, and 36 miles north and south, with Rustenburg near the centre. The geological features are shown according to the surveys made in 1906-7, by A. L. Hall, B.A., F.G.S., and W. A. Humphrey, B.A., PH.D., F.G.S., under the direction of H. Kynaston, B.A., F.G.S. A pamphlet of explanatory text accompanies the sheet.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 23, Emerson, revised to June 10, 1908; 70, Moose mountain, revised to June 4, 1908; 119, Regina, revised to May 21, 1908; 159, Touchwood, revised to May 6, 1908; 271, Mossy Portage, revised to April 22, 1908. Ottawa: Department of the Interior, Topographical Surveys Branch, 1908. *Presented by the Department of the Interior, Ottawa.*

Canada. **Department of Militia and Defence, Ottawa.**

Topographic map of Canada. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Ontario. Sheets: 13, Winchester; 16, Russell. Ottawa: Department of Militia and Defence. London: Geographical Section, General Staff, War Office, 1908. *Presented by the Director of Military Operations.*

The area included in the Winchester sheet lies between 45° and 45° 15′ N. lat. and 75° and 75° 30′ W. long., while that of the Russell sheet, which adjoins the other on the north, extends from 45° 15′ to 45° 30′ N. lat. Topographical features are clearly indicated, contour-lines being shown at 25-feet intervals in brown, wooded land green, and rivers blue.

United States. **U.S. Geological Survey.**

Geologic Atlas of the United States. Folios: 151, Roan mountain: 151, Patuxent; 153, Ouray; 154, Winslow; 155, Ann Arbor; 156, Elk Point; 157, Passaic; 158,

Rockland; 159, Independence. Washington: U.S. Geological Survey, 1907–08. *Price* 0.25$ *each folio. Presented by the U.S. Geological Survey.*

GENERAL.

Astronomical Diagram. **Schmidt.**

Sonnenzeiger für verschiedene Breiten und Jahreszeiten. Von Prof. Dr. W. Schmidt. Vienna: G. Freytag & Berndt, 1908. *Presented by the Publishers.*

Two diagrams of an educational character, folded in one cover, showing the time of sunrise and sunset, duration of twilight, length of day and night for different dates and latitudes, dates of disappearance and reappearance of the sun in the Polar regions, and various other kindred problems. Upon orthographic projections of the sphere shaded to show twilight and darkness, a transparent band can be revolved and set in any suitable position, and then the time of sunrise and sunset, duration of twilight, etc., can be easily read off. By means of these diagrams instructive problems for schools can be worked graphically, which are usually exhibited by means of a globe.

World. **Hickmann.**

Prof. A. L. Hickman's Geographical Statistical Universal Pocket Atlas. Second edition. Vienna and Leipzig: G. Freytag & Berndt, 1909. *Presented by the Publishers.*

A new edition of a useful little pocket atlas which was first published in 1907. It contains altogether sixty-four sheets of maps, plans, and diagrams, and twenty-two pages of text. A special feature of the atlas is the series of graphic and clear diagrams by which statistical information concerning populations, areas, strengths of armies and navies, and other matters, are shown. These have been corrected and brought up to date. The atlas, which is of convenient size for the pocket, is published both in English and German.

World. **Vidal-Lablache.**

Atlas général Vidal-Lablache: Histoire et Géographie. 420 cartes et Cartons: Index Alphabetique de 46,000 noms. Livraison 3. Paris: Armand Colin, 1909. *Price* 1 *fr.* 10 *net each part.*

The following maps are contained in this part of the new edition of this atlas:—69, Europe: Industrie; Matières Premières et Marchés Principaux. 70, 71, France Septentrionale. 72, France: Chemins de Fer; Europe: Chemins de Fer. 93, Italie Politique. 93*a*, 93*b*, Alpes. 93*c*, Régions Industrielles de l'Europe. The usual explanatory notes are printed at the foot of each map.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November, 1908. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
3709 m	= 6·8	Ireland, east coast:—Copeland islands and Donaghadee sound. 3*s.*
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3706 m	= var.	Eastern archipelago, Alas strait and Plans:—Alas strait; Alas strait, northern entrance; Piju bay to Tanjong Ringgit; Kertasari and Taliwang (*Chereweh*) bays; Labuan Haji road. 3*s.*
3715 m	= 2·0	Plans on the south-east coast of China:—Chauan bay. Challum bay anchorage. 3*s.*
3719 m	= 0·49	Plans of reefs in the Coral sea:—Marion reef. 3*s.*
3673 m	= 4·7	South Pacific ocean, Gambier islands:—Manga Reva (*Pearl*) island. 3*s.*

New Plans and Plans added.

3547 m	= 5·9 / 7·0 / 10·0 / 9·0	Scotland east coast:—Logie head to Nairn. Plans added:—Buckie, Lossiemouth. Hopeman. Burghead. 4*s.*
559 m	= 2·1	South America, Magellan strait:—Anchorages in Tierra del Fuego. Plan added:—Allen Gardiner bay. 3*s.*
1103 m	= 0·68	Palao or Pelew islands. Plans added:—Sorol or Philip island. 2*s.*

Charts Cancelled.

No.	Cancelled by	No.
2424 Ireland, south coast:—Valentia to Kinsale.	New chart. Valentia to Cork	2424
1039 Norway:—Christiania harbour.	New chart. Christiania harbour	1032
2168 Ports in Queen Charlotte islands:—Plan of Masset harbour entrance on this sheet.	New chart. Masset harbour	3713
2732 Eastern archipelago:—Plans of Labuan Haji road and Segara bay on this sheet. 895 Eastern archipelago:—Plans of anchorages in Bali, Lombok, Sumbawa, and adjacent islands. Plans of Lombok bay, Alas strait, Piju bay, Taliwang and Chereweh bays on this sheet.	New chart. Alas strait and Plans:—Alas strait, northern entrance; Piju bay to Tanjong Ringgit; Katasari and Taliwang (Chereweh) bays; Labuan Haji road	3706

Charts that have received Important Corrections.

No. 1698, England, south coast:—Dover harbour. 3281, England, south coast:—Portsmouth harbour, mooring ground. 3580, England, west coast and Wales:—Fishguard bay. 2499, Ireland, north coast:—Lough Foyle. 2234, Sea of Azov. 1266, Bahamas:—Islands and banks between San Salvador and San Domingo. 2522, South America, east coast, sheet III.:—Santa Catharina island to Rio de la Plata. 1457, Anchorages in Alaska. 3492, Red sea:—Port Sudan. 1199, China, east coast:—Kue shan islands to the Yang-tse-kiang. 1602, China, north-east coast:—Approaches to the Yang-tse-kiang. 3614, Japan:—Nanao wan. 2460, Pacific ocean:—Kamchatka to Kadiak island, including Bering sea and strait. (*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, January, 1909. London: Meteorological Office, 1908. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, January, 1909. London: Meteorological Office, 1908. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, December, 1908. Washington: U.S. Hydrographic Office, 1908. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, January, 1909. Washington: U.S. Hydrographic Office, 1908. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

British East Africa. **Bois.**

Sixteen photographs of British East Africa, taken by Captain J. Bois. *Presented by Captain J. Bois.*

These photographs were taken during a recent trip along the Guaso Nyiro towards the Lorian swamp and northwards towards Marsabit. The following are the titles:—(1) Guaso Nyiro above Chanler falls; (2) Camp in thick bush on banks of Guaso Nyiro; (3) Country south of Guaso Nyiro; (4) Mount Chaba from the ford on the Guaso Nyiro; (5) Ford on the Guaso Nyiro; (6) On the Guaso Nyiro east of Chanler falls; (7) The Chanler falls; (8) Guaso Nyiro, one day west of Mount Chaba; (9) Line of Guaso Nyiro; (10) View of country north of Embu; (11) Ornaments worn by women, north of Embu; (12) Water-holes of Meville; (13) Water-holes at Sera; (14) Rendile camels going to water; (15) Showing the Samburu method of loading donkeys; (16) Samburu arriving at the water-holes of Kabiye.

Eastern Asia.

Sixty-eight photographs of Eastern Asia. *Presented by A. S. Waley, Esq.*

A series of photographs of China, Siam, Cambodia, and Malay States, of various

sizes and subjects. If some of them are not strictly geographical in character, they are all interesting. The panorama of Shanghai, the general view of Hong Kong from Victoria peak, and some of the others, are specially good. The titles are as follows:—

(1 and 2) View of Hong Kong; (3) Hong Kong from Victoria peak; (4) Government house, Hong Kong; (5) Botanical gardens, Hong Kong; (6 and 7) The race-course, Hong Kong; (8) The Peak railway, Hong Kong; (9) Chinese temple, Hong Kong; (10 and 11) Execution of pirates, Kowlun; (12) Street in Canton; (13) Garden in Canton; (14) The Dragon boat, Canton; (15) Temple of five hundred Genii, Canton; (16) Shanghai; (17) Chifu; (18) The Great Wall of China; (19) Peking; (20) The entrance to the Forbidden City, Peking; (21) View of Forbidden City from the walls; (22) View of the palace, Peking; (23) Forts on the walls, Peking; (24) One of the gates, Peking; (25) Portion of the wall round Chinese city, Peking; (26) On the wall, Peking; (27) Peking from the wall of the Tartar city; (28) Scene at Tung Lei; (29, 30, and 31) Post-office, Saigon; (32) Cathedral, Saigon; (33) Resident's house, Sambor; (34) Mrs. Bujois' house, Sambor; (35) At Sambor; (36) At Dau; (37 and 38) Starting from Dau; (39) View at Pnom Sala; (40) The house of the chief of Pnom Sala; (41) Our hut at Pnom Sala; (42) At Kratié; (43) Ruins at Kratié; (44) Dying elephant; (45) The great Pnom, Pnom Penh; (46) On the Mekong at Pnom Penh; (47) Temple near Pnom Penh; (48) Wooden building erected at Pnom Penh to bury the queen's body in; (49) Boat in which I came down the Mekong rapids; (50) Natives of Cambodia; (51) Arrival of beaters, Cambodia; (52 and 53) Bangkok; (54) Temple at Bangkok; (55) The great temple, Bangkok; (56) A Siamese girl, Bangkok; (57) Pagoda, Bangkok; (58) One of the entrances to the palace, Bangkok; (59) Gate, Bangkok; (60) The palace, Bangkok; (61) Cavanagh bridge, Singapore; (62) Singapore; (63) A Malay village, Singapore; (64) Cutting road through jungle, Singapore; (65) Country road, Singapore; (66) Penang from the hill; (67 and 68) Streets in Penang.

Northern Nigeria. **Cruz.**

Eleven photographs of Northern Nigeria, taken by Mr. V. Cruz. *Presented by Captain fforde Searight, K.D. Guards.*

As may be gathered from the titles, these photographs are specially interesting in connection with the new Baro-Kano railway now in course of construction. They serve well to show the development of Northern Nigeria, and in years to come will have an historic interest.

(1) River Niger near Baro; (2) Lokoja market; (3) Portion of railway bridge over Kaduna river at Zungeru; (4) Rivers Benue and Niger at Lokoja; (5) Baro; (6) Laying the line at Baro; (7) Discharging railway material at Baro; (8) Transport cart at Zungeru; (9) Washing in the Niger; (10) Side stream in Kaduna river at Zungeru; (11) Woman spinning cotton.

Northern Nigeria. **Searight.**

Thirty-eight photographs of Northern Nigeria, taken by Captain fforde Searight, K.D. Guards. *Presented by Captain fforde Searight.*

Some of the subjects of this series of photographs are of special interest. They are all typical of the country, its people, and scenery.

(1) Commandant's house, Zungeru; (2) Street in Ringim; (3) Seriki's (king's) house, Ringim; (4) Gate at Ringim; (5) Making a roof, Ringim; (6) Praying for rain, Katagum; (7 and 8) Emir of Hadeija; (9) A gate at Hadeija; (10) Wall of Hadeija; (11) My pack-bullocks; (12) View of Kano; (13) Emir of Kano; (14) Emir's private mosque, Kano; (15) Interior of palace walls, Kano; (16) Gateway of Emir's palace, Kano; (17) The Residency, Kano; (18) Commandant's house, Kano; (19) Mata gate, Kano; (20 and 21) Market, Kano; (22) Offices, Kano; (23) Horsemen at Ramadan, Kano; (24) Ramadan, Kano; (25) Doctor's house, Kano; (26) Indigo dye pits, Kano; (27) Official buildings, Sokoto; (28) Inside the fort, Sokoto; (29) Bush at Suwo; (30) Fort at Dumjiri; (31) Dumjiri; (32) Official residencies, Dumjiri; (33) Court-house, Dumjiri; (34) Guard room, Dumjiri; (35) A little musselman, Dumjiri; (36) View near Dumjiri; (37) Waube river, Dumjiri; (38) Emir's summer palace.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

THE JUBILEE OF SPEKE'S DISCOV

MAPS OF

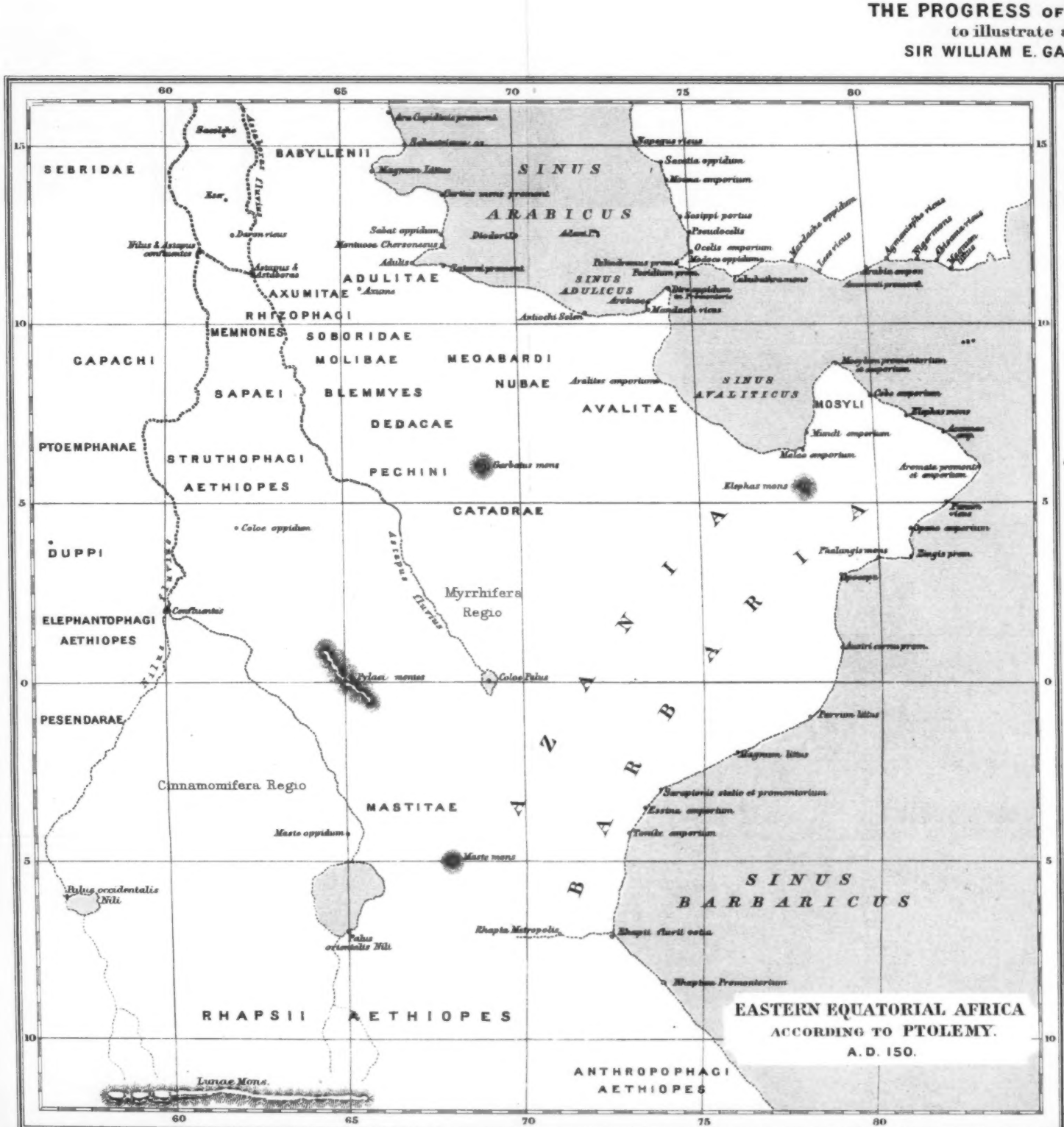
EASTERN EQUATORI

showing

THE PROGRESS OF EXP

to illustrate a pap

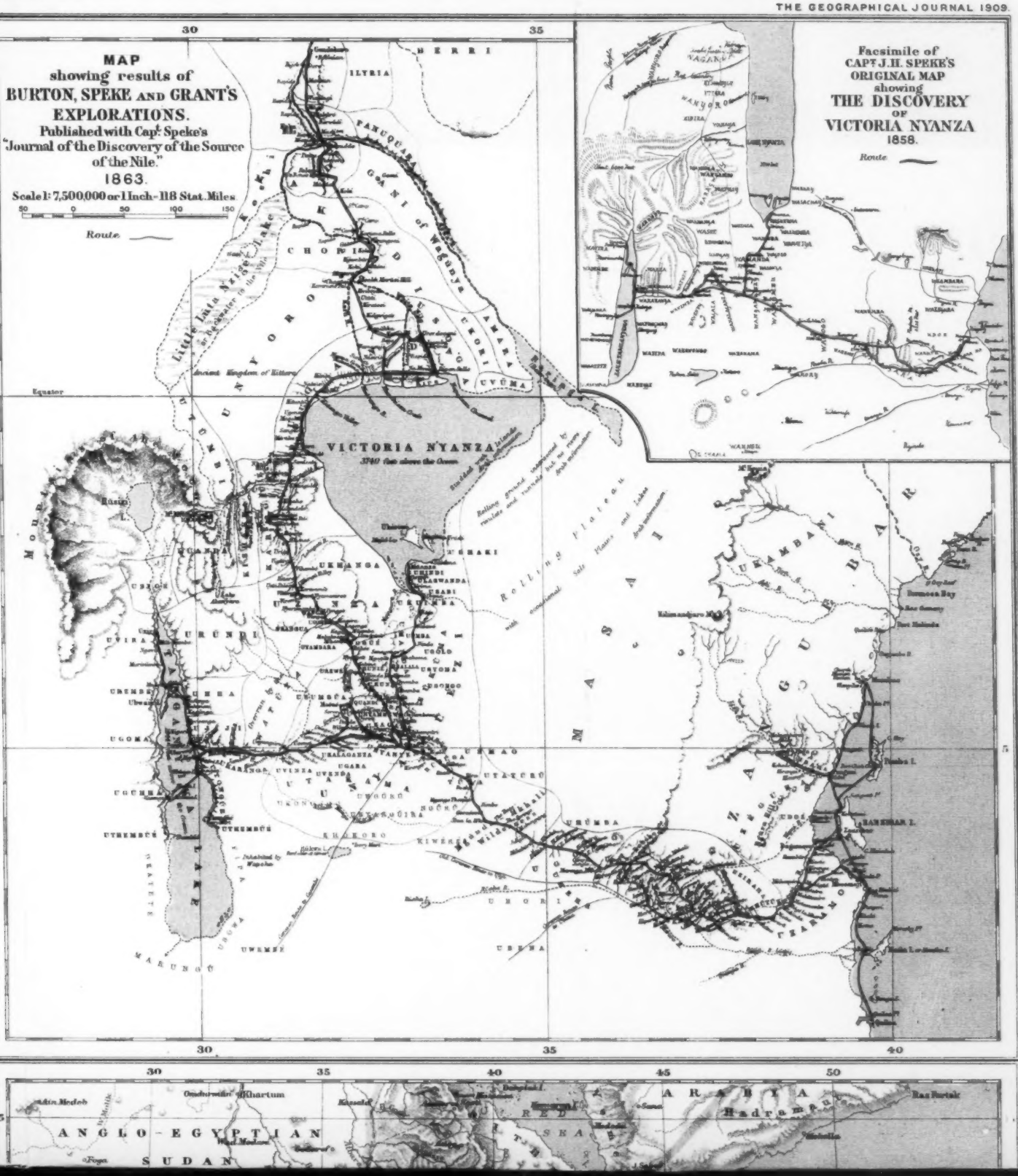
SIR WILLIAM E. GARSTI

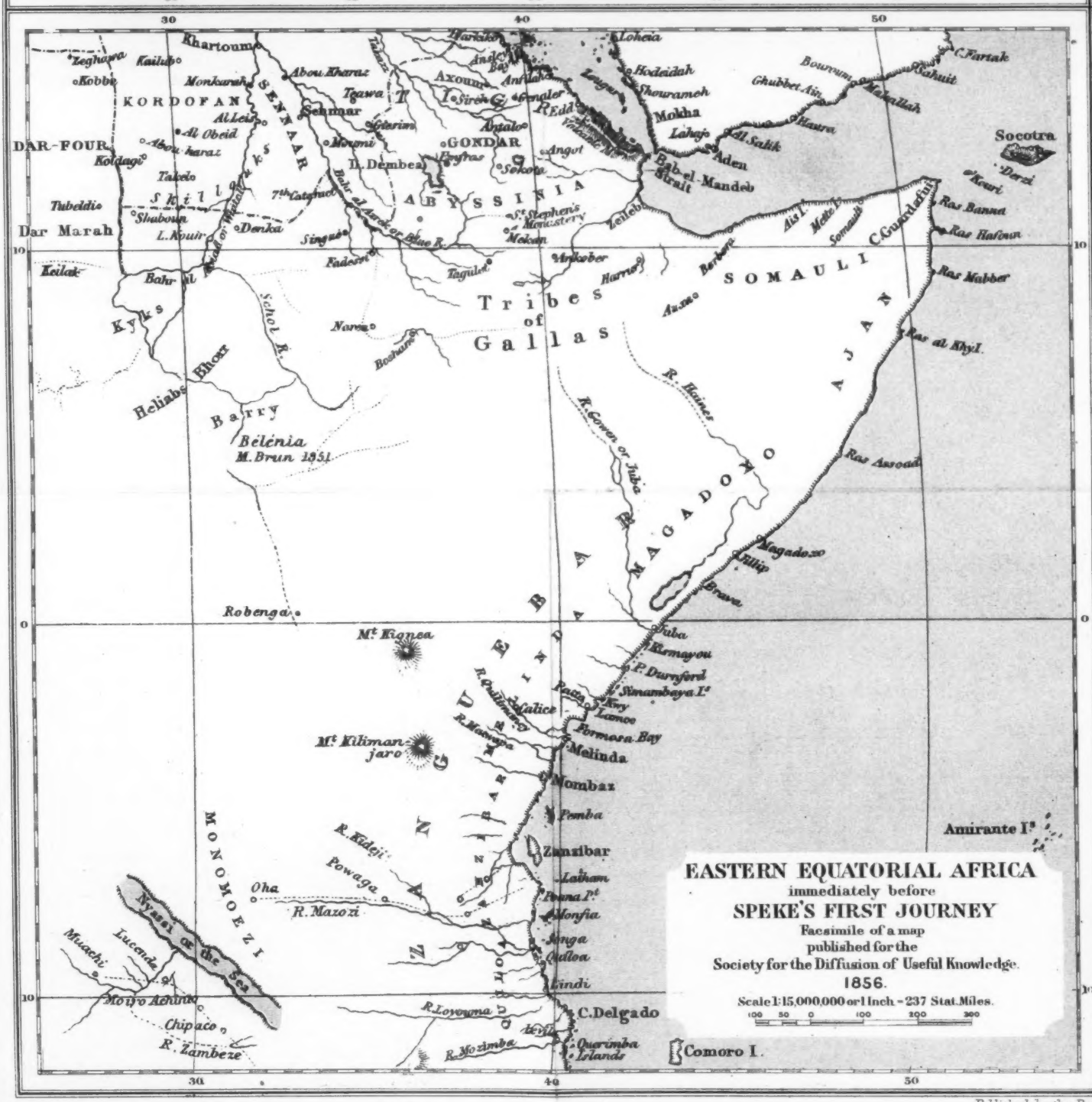


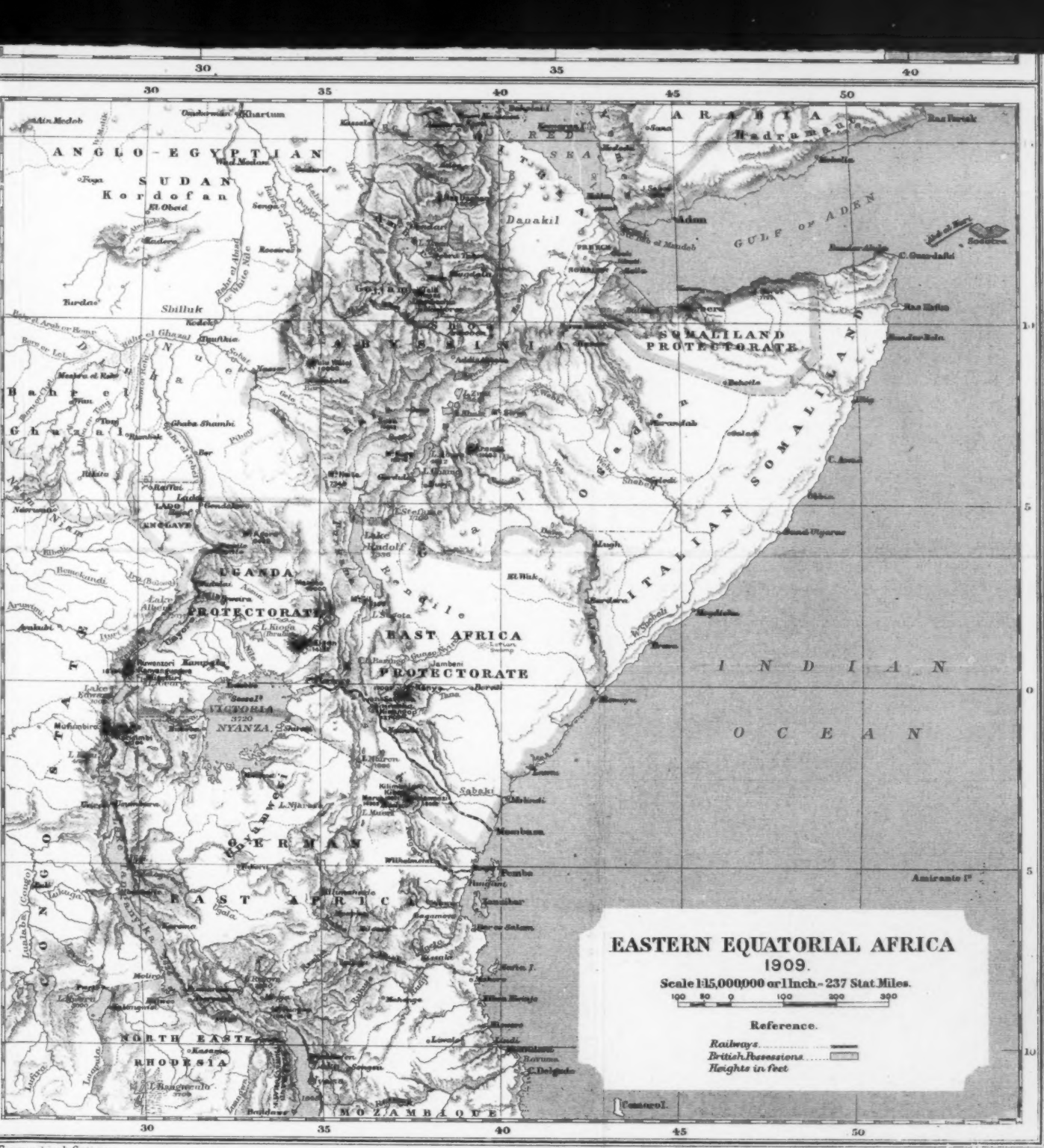
OVERY OF VICTORIA NYANZA
OF
ORIAL AFRICA
g
EXPLORATION

paper by
STIN, G.C.M.G.

EASTERN EQUATORIAL AFRICA.
Garstin.


MAP
showing results of
BURTON, SPEKE AND GRANT'S
EXPLORATIONS.
Published with Capt. Speke's
"Journal of the Discovery of the Source
of the Nile."
1863.
Scale 1: 7,500,000 or 1 Inch = 118 Stat. Miles
Route
Facsimile of
CAPT J. H. SPEKE'S
ORIGINAL MAP
showing
THE DISCOVERY
OF
VICTORIA NYANZA
1858.
Route
VICTORIA NYANZA
3740 feet above the Ocean
Rolling Plateau
Rolling ground, cultivated in
patches and forested, but no open
bush-country
with occasional Salt Plains and Lakes
Ancient Kingdom of Kittara
Little Lake Nzige
or Albert Nyanza
Equator
UNYORO
UGANDA
KAVIRONDO
USOGA
UKEREWE
UKEREWE I.
UKUMBI I.
UKARA
UZINZA
UHA
UHHA
UVINZA
UJIJI
UGOMA
UBUNDU
UHEMBE
UTHEMBE
UTAMBARA
UKAMBA
UKAMBANI
MASAI
NGURU
UZARAMO
UKAMI
UKUNDU
UKWERE
UKWERE I.
UMBA
UMBA I.
UMBA R.
MOUNTAINS OF THE MOON
Ruwenzori
Mfumbiro
Kisiba
Kagehi
Kavirondo Gulf
Speke Gulf
Ukerewe I.
Ukumbi I.
Kilimanjaro Mt.
Mombasa
Pemba I.
Zanzibar I.
Dar-es-Salaam
Bagamoyo
Kwale
Rabai
Melinde
Kau
Kipini
Witu
Lamu
Pate I.
Manda I.
Kismayu
Brava
Barawa
Merka
Mogadisho
Warsheikh
Obbia
Hafun
Ras Hafun
Guardafui
Cape Gardafui
Ras Asir
Ras Filuk
Bunder Bay
Port Melinde
Port Durnford
Port Victoria
Port Alice
Port Thomas
Port Madoc
Port Pitt
Port Loyd
Port Alexander


Khartoum
Zeghawa
Kailuk
Kobbie
Monkurah
KORDOFAN
Abou Kharaz
Tegwa
Sennaar
Axoum
Antalo
GONDAR
Lake Dembea
Sokota
Angot
Hodeidah
Mokha
Lahaja
Aden
Babel-Mandeb Strait
Socotra
Derzi
Keseri
Ras Banna
Ras Hafoun
Ras Mabber
Ras al Khyl
Ras Asswad
Magadoxo
Brava
Juba
Kimayou
P. Durnford
Sinambaya I.
Melinda
Mombaz
Pemba
Zanzibar
Latham
Pouna Pt.
Monfia
Kilwa
Lindi
C. Delgado
Querimba Islands
Comoro I.
Amirante Is.
DAR-FOUR
Koldagi
Tabelo
Tubeldie
Shabona
Dar Marah
L. Kouri
Denka
Tsilloa
ABYSSINIA
Debra Libanos
St. Stephen's Monastery
Mekan
Zeileh
Berbera
SOMAULI
Tribes of Gallas
Harrar
Aussa
Ankober
Fadesm
Tagulat
Singue
Bahr el Abiad or White R.
Bahr el Azrek or Blue R.
Kellak
Kyks
Schoa R.
Nanna
Boshano
Helibs
Bhoor
Barry
Belenia
M. Brun 1851
Robenga
Mt. Kenia
Mt. Kilimanjaro
R. Quilimane
R. Mazoia
R. Kidgi
Powaga
Oha
R. Mazoi
MONOMOEZI
Nyassi or the Sea
Lucanda
Muachi
Moiro Achinta
Chipaco
R. Zambeze
R. Lovuma
R. Mozimba
ZANZIBAR
UZARAMO
UZIGUA
MAGADOXO
AJAN
R. Hainer
R. Govan or Juba
Formosa Bay
Lamoo
Patta
Malice
Key
Gillip
Bowrum
Ghubbet Aiz
Makallah
Sahuit
C. Fartak
Haura
Al Sakik
Mocha
Showramoh
Loheia
Anfila Bay
Arkiko
Taranta
Sirek
Enderta
Adowa
Axum
Tigre
Antalo
Samhar
Sitarim
Mosmi
Al Obeid
Al Leis
Abou Harraz
Kobbie
Tubeldie
Shabona
Dar Marah
L. Kouri
Denka
Singue
Fadesm
Tagulat
Ankober
Harrar
Aussa
Berbera
Somauli
C. Guardafui
Mette I.
Als I.
Zeileh
Babel-Mandeb Strait
Aden
Lahaja
Mokha
Showramoh
Hodeidah
Loheia
Anfila Bay
Arkiko
Taranta
Sirek
Enderta
Adowa
Axum
Tigre
Antalo
Samhar
Sitarim
Mosmi
Al Obeid
Al Leis
Abou Harraz
Kobbie
Monkurah
Tegwa
Sennaar
Khartoum
Zeghawa
Kailuk
Tsilloa
Debra Libanos
St. Stephen's Monastery
Mekan
Angot
Sokota
Lake Dembea
Derzi
Keseri
Socotra
Ras Banna
Ras Hafoun
Ras Mabber
Ras al Khyl
Ras Asswad
Magadoxo
Brava
Juba
Kimayou
P. Durnford
Sinambaya I.
Melinda
Mombaz
Pemba
Zanzibar
Latham
Pouna Pt.
Monfia
Kilwa
Lindi
C. Delgado
Querimba Islands
Comoro I.
Amirante Is.
Bowrum
Ghubbet Aiz
Makallah
Sahuit
C. Fartak
Haura
Al Sakik
Aden
Babel-Mandeb Strait
Lahaja
Moc



EASTERN EQUATORIAL AFRICA
1909.

Scale 1:15,000,000 or 1 Inch = 237 Stat. Miles.

100 50 0 100 200 300

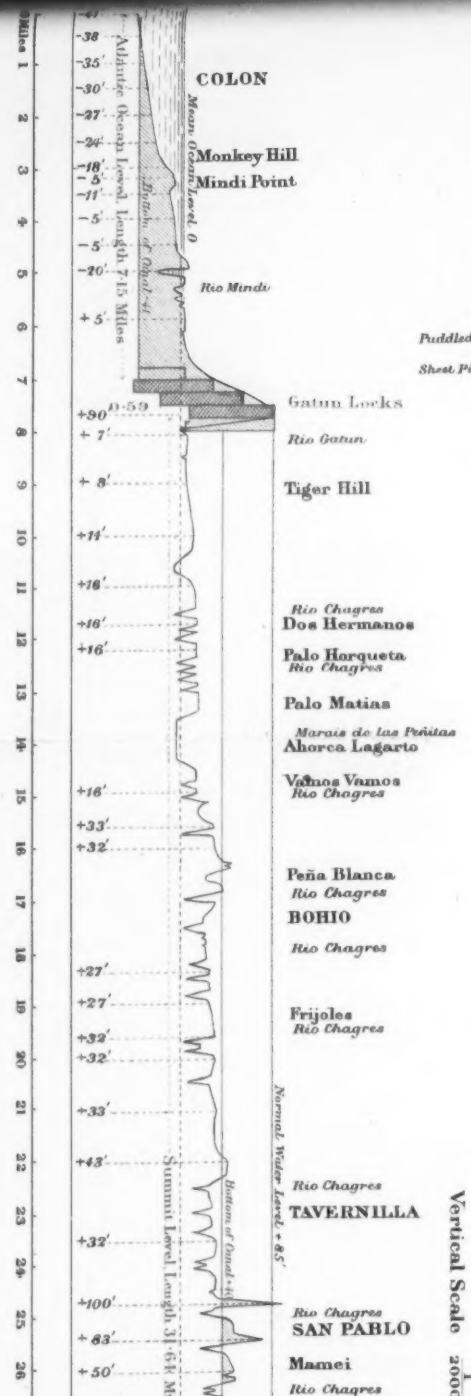
Reference.

Railways

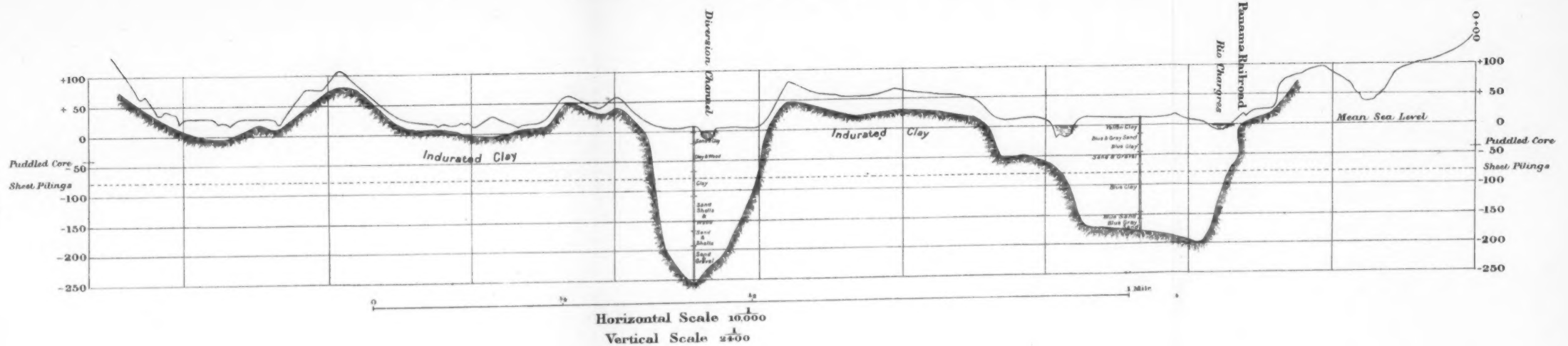
British Possessions

Heights in feet

Geographical Society



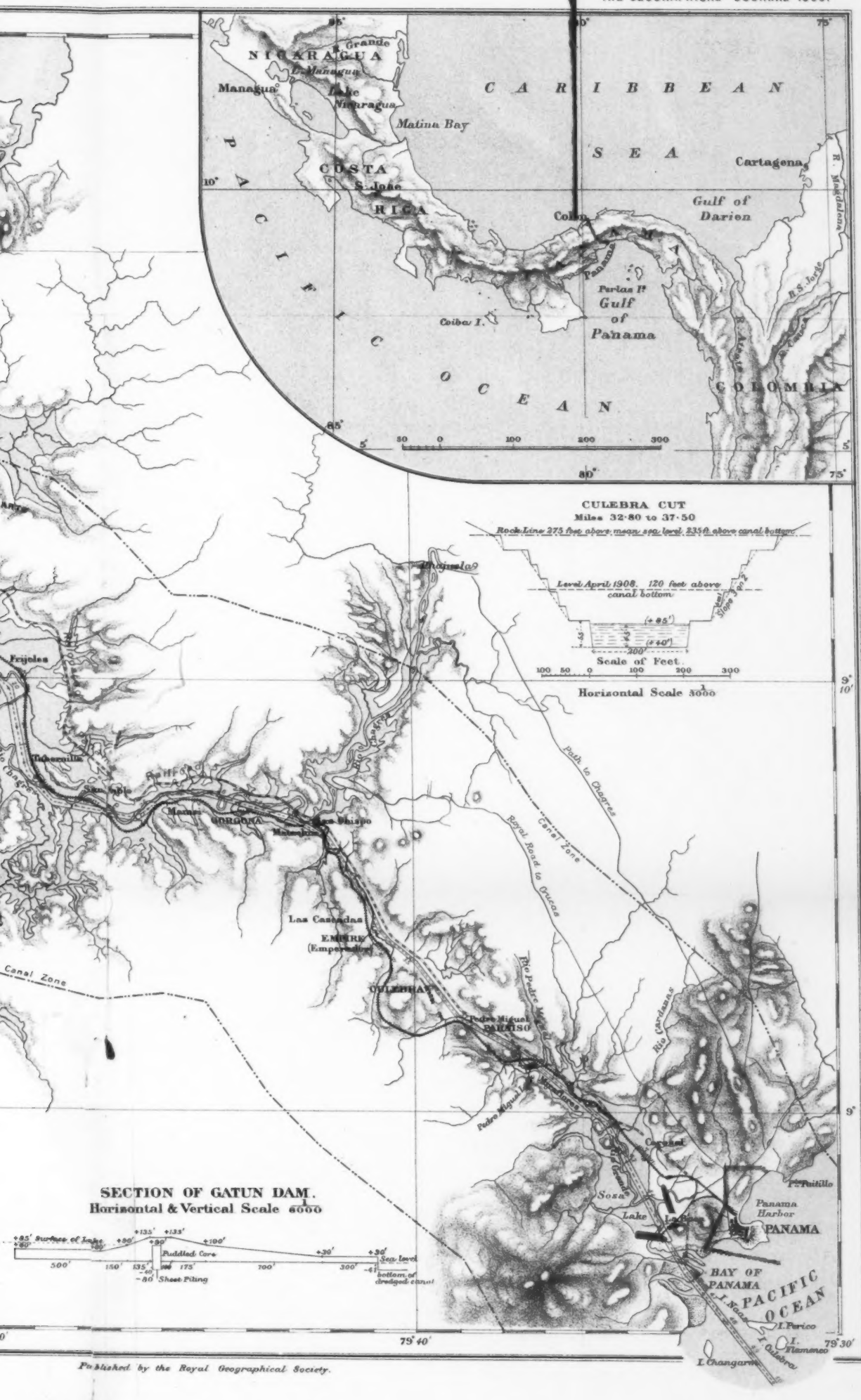
PROFILE OF GATUN DAM BORINGS



THE PANAMA CANAL
from the reports of the
ISTHMIAN CANAL COMMISSION
illustrating a paper by
VAUGHAN CORNISH, D.Sc.
Nat. Scale 1:200,000 or 1 inch = 3·156 Stat. Miles.
Datums
ATLANTIC OCEAN
CARIBBEAN SEA
LIMON BAY
Colon Harbor
COLON
Monkey Hill
Manzanillo Bay
Rio Mindi
Rio Gatun
Rio Trinidad
GATUN LAKE
LOMA DE PALENQUILLA
LOMAS AHORCA LAGARTO
BOHIO
Rio Chagres
Frijoles
Canal Prism
Rio Boquerón
Rio Obispo
Rio Grande
Rio Caño Quebrado
Rio Agua Clara
Rio Gigante
Rio Pena Blanca
Rio Palenquilla
Rio Palo Seco
Rio Caño Sucio
Rio Caño Negro
Rio Caño Quebrado

THE PANAMA CANAL.

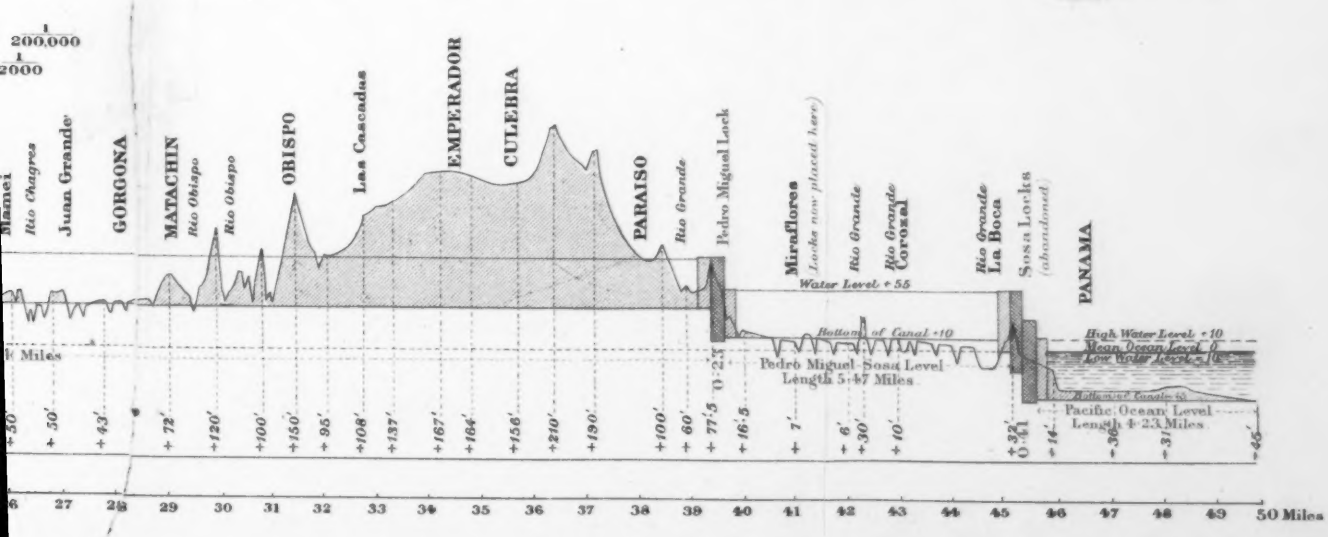
CORNISH.



SECTION OF GATUN DAM.

Horizontal & Vertical Scale 1/6000

Published by the Royal Geographical Society.



33°

2°

UGANDA PROTECTORATE

VICTORIA NYANZA TO LAKE KIOGA (IBRAHIM)

From a Survey by

LIEUT. C. E. FISHBOURNE, R.E.

1907-8.

Scale 1 : 500,000 or 1 Inch = 7·89 Stat. Miles.

5 4 3 2 1 0 5 10 15 Miles

Reference.

Streams waterless in dry season	
Roads fit for wheeled traffic	
" " " " " (Slightly improved)	
Native tracks to Shambas and Huts	
Form lines	
Trig. Station and heights in feet	▲4074
Aneroid heights in feet	3411

Dokolo Hill
Dokolo Rest Ho.

Thickly populated much cultivation

U M I R

Perkira

Puhulu 4518

Kaveri I.

Ferry

Ogera Mt. 4462

Thickly populated much cultivation

LAKE KIOGA (IBRAHIM) 3424

1° 30'

KAGWARA

Namioka I.

Bush

R. Sipi

Kasi

Shambas

Madoba

Wabusesis

Rest Ho. Kigungu

Kakoge

Ikanda

Emeri

Bush and Grass

Nabigoga

Nabirumba Rest Ho.

Nabekomba R.

Kakindo

Mile navigable from Kakindo to Macoba.

Ferry

Falls

Falls

Shambas

Elephant Grass

Senpoke

4139

Kiunga

Ripon Falls

By permission of the Secretary of State for the Colonies.

33°

Published by the Royal Geograp

VICTORIA NYANZA TO LAKE KIOGA.
FISHBOURNE.

H. Hanly, lith.